IAGEMENT

California
Desert
District

# An Archaeological Inventory Report of the Owlshead/Amargosa – Mojave Basin Planning Units of the Southern California Desert Area

by
Richard H. Brooks,
Richard Wilson,
and Sheilagh Brooks



cultural resource publications
anthropology – history

Cover illustration by Clara Stapp. Geoglyph in upper right hand corner is a serpent-like figure scraped into the desert pavement at Denning Spring in the Avawatz Mountains. The geoglyph is approximately 200 meters long and follows an east-west ridgeline.

# FOREWARDS

During the process of developing the Bureau of Land Management's multiple-use plan for the California Desert Conservation Area in the late 1970's, it becomes apparent that the short time allowed for field work necessitated assistance by non-Bureau contractors. Such was the case for archaeological inventories.

Since BLM's Desert Planning Staff archaeologists, under my direction, had initiated a regional approach (discussed in Appendix D of the Desert Plan), it was felt imperative that contractors generally should follow compatible methods with allowances for some individual flexibility. This would allow for data comparisons while at the same time providing the contractor certain freedoms and initiative.

In this report, Dr. Brooks and his co-workers of the University of Nevada, Las Vegas, Archaeological Research Center, have completed one of the regional studies for the BLM for a key area in both the Mojave and greater California Desert. This region has been, and continues to be, a focal point for researchers since the early days of California archaeology.

The Archaeological Research Center has provided a report which clearly shows the importance of the region, the diversity of cultural resource present, their significance and the general environmental zones of greater or lesser cultural resource sensitivity. It is a valuable contribution to Mojave Desert archaeology. A companion volume by Claude Warren, Martha Knack and Elizabeth von Till Warren (1980), providing a detailed overview of the region's archaeology, history and ethnography, including a discussion of the local environment, has neen previously printed in this series. Together these works provide information meaningful to those who appreciate the desert and its resources.

Eric W.Ritter
General Editor

I wish to thank all of those who have supported the archaeology program in the California Desert in its efforts to print and disseminate cultural resource data to the general and professional public. Among those are Gerald Hillier, Dick Freel, Bruce Ottenfeld, Bary Freet, Ronald Keller and Bill Olsen. A special note of thanks goes to Clara Stapp who did the front cover and the appropriate typing of Jenise Aboytes.

A special note of thanks is to be extended to the Brook's for retyping the manuscript into a single-space format. As sometimes happens in this field the original double-space manuscript disappeared and no other printable copies existed. The Brook's, at their own expense, gratiously had it retyped.

I hope that in these days of constrained budgets that the reprinting and dissemination of Cultural Resource Reports will be further accomplished and encouraged by management and staff alike.

Russell L. Kaldenberg
Cultural Resource Program Manager
Publications Coordinator
California Desert District

# AN ARCHAEOLOGICAL INVENTORY REPORT OF THE OWLSHEAD/AMARGOSA-MOJAVE BASIN PLANNING UNITS OF THE SOUTHERN CALIFORNIA DESERT AREA

by

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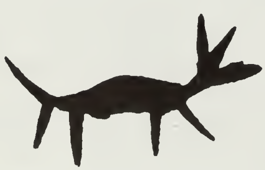

Petroglyph from Mesquite Springs in the Mojave Basin Planning Unit near Baker, CA.

# LIST OF MAPS AND TABLES

LIST OF MAPS AND TABLES
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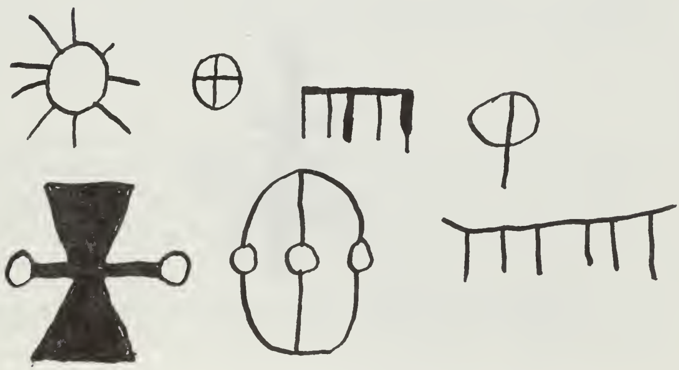


Various petroglyph elements from Mesquite Springs.

## ABSTRACT

This project is part of a series of studies being done in the California Desert by the Bureau of Land Management. The area inventoried is 1% of approximately one million acres, or 10,880 acres located in the southern half of the Owlshead/ Amargosa Planning Unit and the Mojave Basin Planning Unit. To survey the project area at the 1% amount, a minimum requirement of 136 one mile long by one-eighth mile wide transects were walked. Twelve additional transects were surveyed to provide corroborative data for certain key areas.

The sample design was divided into three stages; the first completely random in transect selection, the second pragmatically random and the third non-random. To interrelate the environmental variables, six geomorphic strata, or locales, were designated, consisting of mountain/hill, pediment/arroyo, playa, dune, Mojave Sink and lava. A total of 151 historic and prehistoric sites was encountered during the survey.

As the background for understanding the site distribution patterns and the resource potentials of the project area, sections are included concerning the history, geography/ geomorphology, biota, and ethnography.

Each site encountered is briefly described as to content and locale and evaluated. The frequencies of site occurrence by position of the transects within the six geomorphic strata are considered with the implications of the results of this data for site prediction. Site distribution and frequencies are also discussed in relation to geomorphic locale and to site type, historic or prehistoric. Geomorphic locale is shown to be more predictive of site distribution than the geomorphic stratum of the transects.

Petroglyph element from Rogers' M-36 at Saratoga Springs

# INTRODUCTION

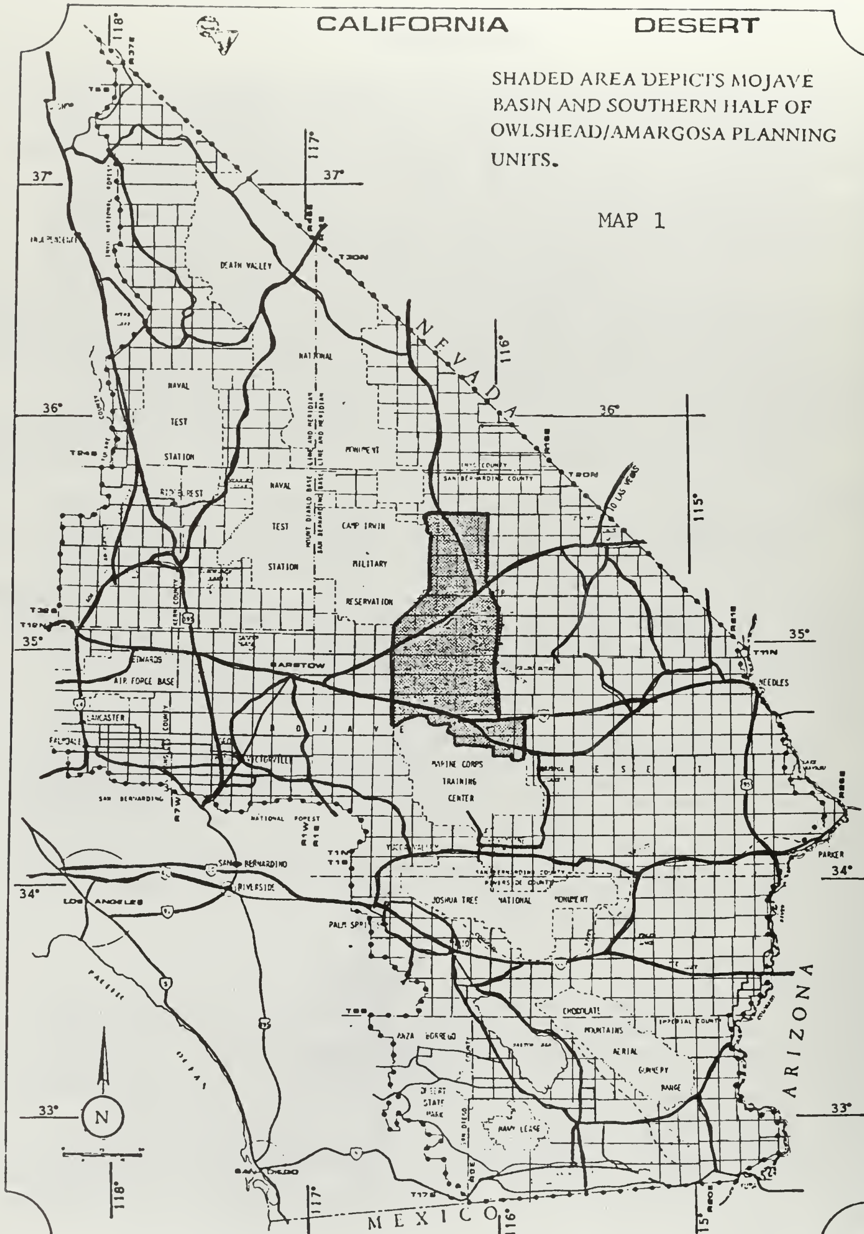
This report consists of a cultural resource inventory (Class II) for the southern Owlshead/Amargosa and Mojave Basin Planning Unit, within the California Desert. These planning units cover approximately one million acres in the east-central part of the California Desert, within San Bernardino County, California. "The Mohave Basin unit is bounded on the east by the Bristol Mountains and an area slightly east of Soda Lake, on the north by Interstate 15, the Soda Mountains and Camp Irwin Military Reservation on the west by the Cady Mountains, and on the south by the Twenty-Nine Palms Marine Corps Training Center. The southern half of the Owlshead/Amargosa Planning Unit is bounded on the north by an east-west line from the Avawatz Mountains (at the northeast corner of Camp Irwin Military Reservation) to the Silurian Hills, on the west by the Camp Irwin Military Reservation, on the south by the Soda Mountains and Interstate 15 and on the east by a line three miles east of Silver Lake north of the Silurian Hills and Valjean Valley" (BLM, 1977:26).

Following the detailed instructions itemized in BLM YA-512-RFP7-120 a bid proposal was submitted to the Bureau of Land Management Office (BLM) in Denver, Colorado, by the Archaeological Research Center, Museum of Natural History, University of Nevada, Las Vegas (UNLV), Nevada. On acceptance of the proposal, Project and Contract Number YA-512-CT7-250 was issued by the BLM to the Research Center. Eric Ritter, archaeologist in charge of the BLM Desert Planning Unit, Riverside, California, is the COAR on this project.

The project was divided into four interrelated parts, which were 1) the sampling design development; 2) the field implementation, including ground coverage, site analysis and recording; 3) site evaluation based on surface observations in the field; 4) the analysis of the data in the laboratory leading to the preparation of a Class II inventory report. All four parts of the project were undertaken by Research Center personnel or qualified consultants who cooperated in their field of expertise.

## Personnel

The project was directed in the field and during the laboratory analysis by Richard H. Brooks, Director of the Archaeological Research Center and the Museum of Natural History, UNLV. Field crew personnel who participated in no other aspect of the project than surveying transects were Lynda Brennan, Martin E. Bussard, Robert Ellis, David Ferraro, James Foley, Carol A. Hepp, Michael Plyler and Grant Tullis. Surveying of the transects was considered to include preparation of field notes, field maps, site records and the identification of photographs taken of transects or sites.


CALIFORNIA DESERT
SHADED AREA DEPICTS MOJAVE BASIN AND SOUTHERN HALF OF OWLSHEAD/AMARGOSA PLANNING UNITS.
MAP 1
DEATH VALLEY
NATIONAL
MONUMENT
NAVAL
TEST
STATION
NAVAL
TEST
STATION
CAMP IRWIN
MILITARY
RESERVATION
NEVADA
BARSTOW
EDWARDS
AIR FORCE BASE
LANCASTER
VICTORVILLE
MOJAVE
DESERT
MARINE CORPS
TRAINING
CENTER
NEEDLES
PARKER
SAN BERNARDINO
RIVERSIDE
LOS ANGELES
JOSHUA TREE NATIONAL MONUMENT
PALM SPRINGS
CHOCOLATE
MOUNTAINS
AERIAL
GUNNERY
RANGE
ANZA BORREGO
DESERT
STATE
PARK
NAVY LEASE
SAN DIEGO
ARIZONA
MEXICO
37°
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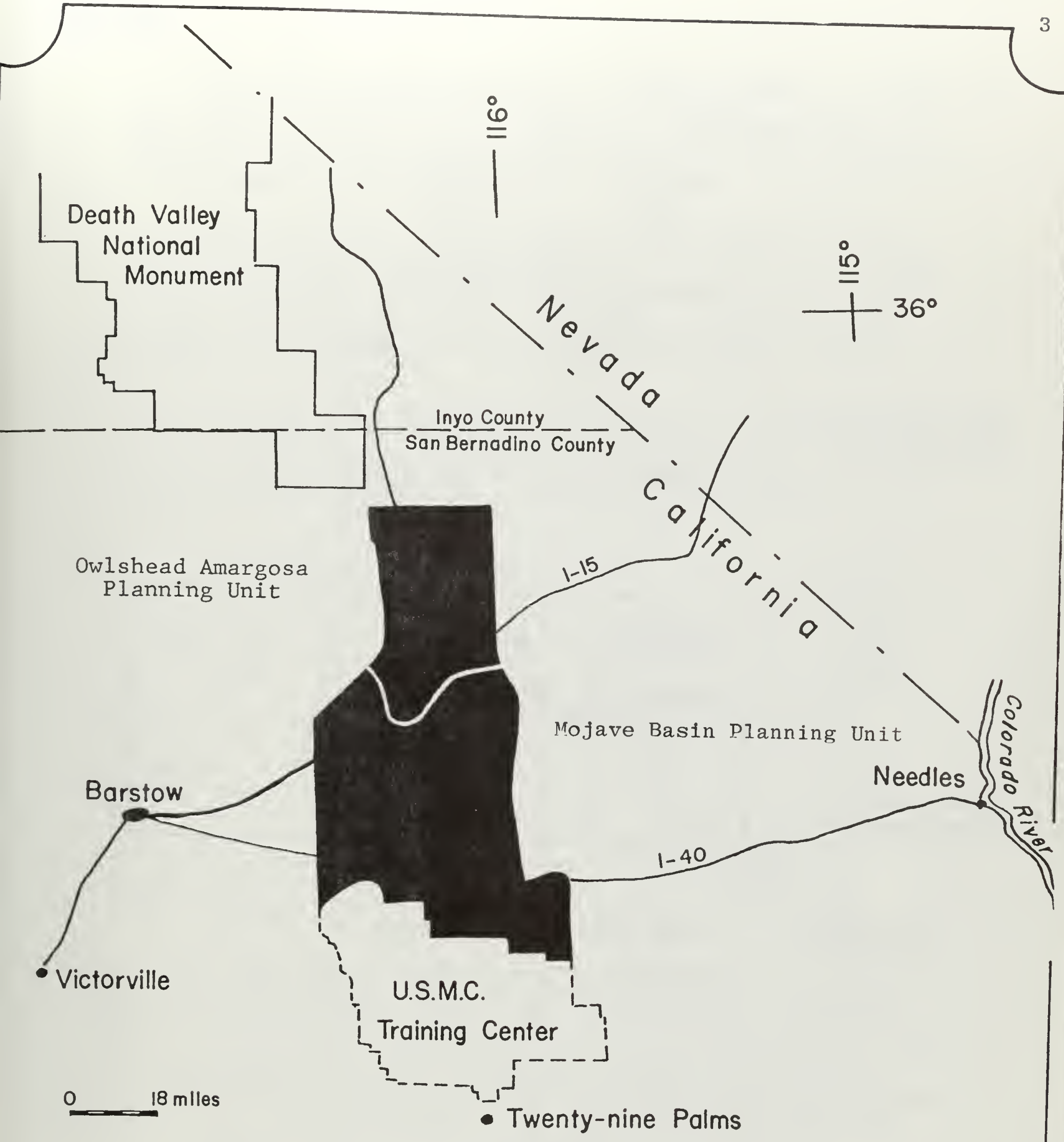
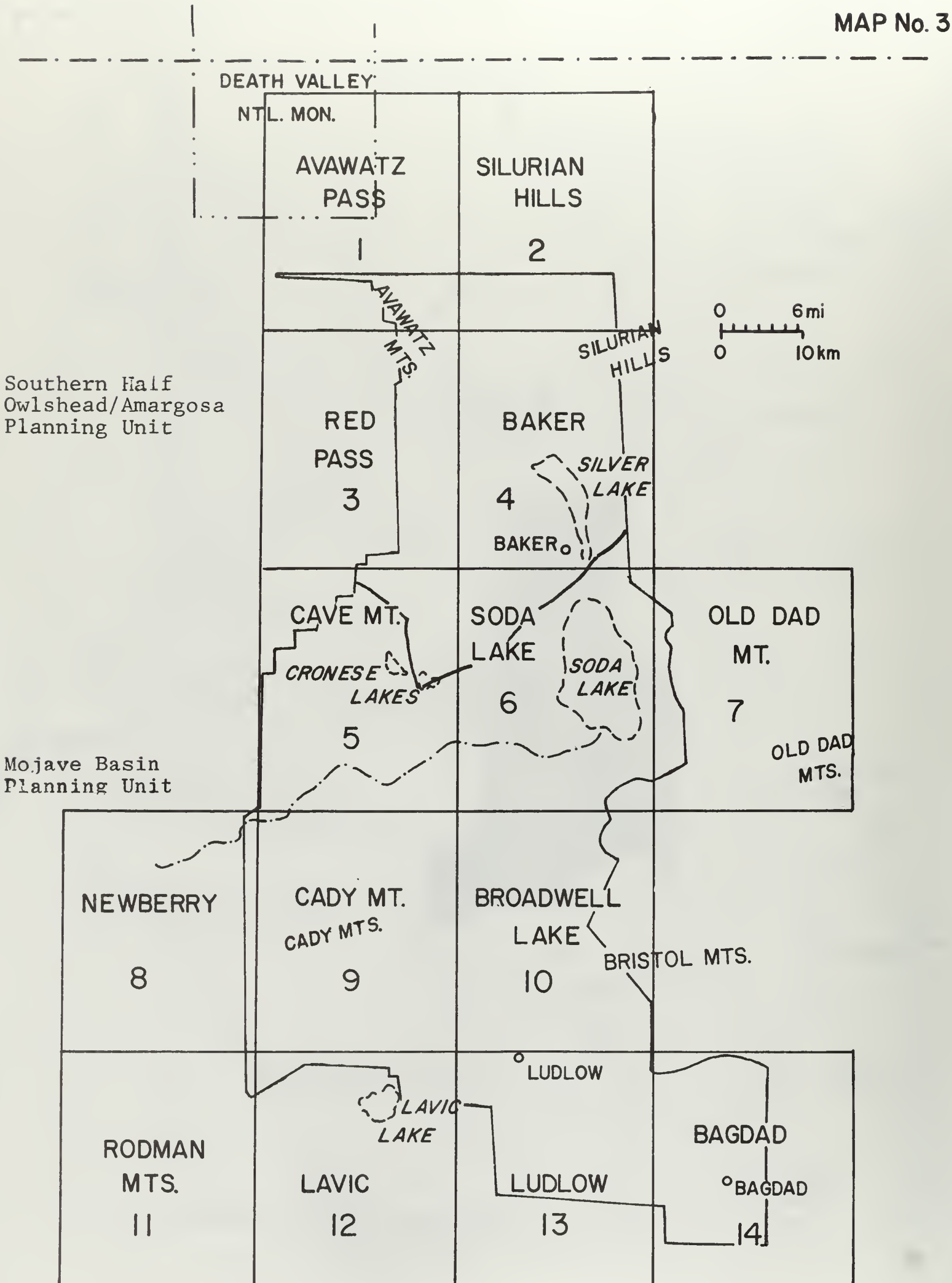



**Map 2**
Shaded area depicts the Mojave Basin and the southern half of the Owlshead/Amargosa Planning Units.

MAP No. 3




Showing Quadrangle location with respect to the southern half of the Owlshead/Amargosa-Mojave Basin Planning Unit.

Personnel who participated in both the field survey and some aspect of the laboratory analysis included Joseph P. King, ethno-botanist, Matthew McMackin, cartographer-geologist, Cary M. Stevens, photographer, and Richard A. Wilson, field and technical supervisor.

Arnie Cunningham Turner worked on the project in the laboratory and researched the ethno-history; Dr. Ralph Roske, History Department, UNLV, researched and wrote the historical section; and Margaret Miller, archaeological statistician, Nevada Archaeological Survey, University of Nevada, Reno, prepared the sampling design and conducted the statistical analysis.

Pattie Baldwin, Management Assistant II, Archaeological Research Center, assisted in the preparation of all budgetary matters, maintained all personnel records and served as the Research Center liaison person. Dr. Sheilagh Brooks, Anthropology Department, UNLV, edited the Class II inventory report.

In response to a supplement to the contract, provision was made by the Research Center to employ a Native American during the final phases of the survey. After consultation with the secretary of the Moapa Indian Reservation, a young man, who is a Paiute Indian, was suggested by the secretary as a potential employee. When the project was explained to Henry Gary, he accepted the job of Native American field consultant, and agreed to accompany the Research Center personnel in the field during the final phase of the survey. Gary spent a total of ten days in the field with the survey crews, conducting research in the areas of Ludlow, Mojave Sink, and East and West Cronese Lakes. During this time he participated in the survey, he walked transects with two different groups of crew personnel, Wilson and Hepp, and later with Bussard and Tullis. While in the field, Gary walked transects with each group, observing and recording the flora, fauna and archaeological sites.

Gary had the capability to identify archaeological sites and was familiar with the prehistoric artifacts, tools and assemblages within the sites. His father and he, when he was younger, had located prehistoric sites in the vicinity of the Moapa Reservation. His father had indicated the artifacts and other identifying site material to him, and told him how to recognize these types of data. Gary discussed with crew members his impression that, as both a Native American and a crew member, he could understand and provide insight into the background of the aboriginal peoples who had left these prehistoric remnants of their cultural past.

Contacts with the COAR

On October 16, 1977, the initial contact was made with

Eric Ritter, the COAR, at the Riverside Office of the BLM, where the Desert Planning Unit was then located. R. H. Brooks and P. Baldwin, accompanied by S. T. Brooks, met with E. Ritter, Richard Brook and other members of the Desert Planning Unit staff, to discuss the approach to be utilized in conducting the survey project in concurrence with the contract agreements. Subsequently, on January 3, 1978, E. Ritter and R. Brook met in Las Vegas with R. H. Brooks, R. Wilson, D. Ferraro and M. Miller, who had flown from Reno for this consultation. At this meeting the initial transects for the first stage of the survey were randomly selected, and it was determined that the field portion of the project would consist of three stages. The statistical methods that M. Miller proposed to utilize for the analysis of the transect survey were discussed with E. Ritter and R. Brook and clarified at this time.

R. H. Brooks and R. Wilson spent from February 1 through February 3, 1978, at the Desert Planning Unit Office in Riverside, gathering the background data available there on the project area, including known sites, water, vegetation, geology, etc. At this meeting, E. Ritter suggested that the ZZYZX Research Center could be used as a base of field operation during the survey of transects in that area. Through his assistance permission was obtained for field crews to stay at the ZZYZX Research Center when working in that vicinity.

Twice during the spring field sessions, when the crew was surveying transects in the northern portion of the project area, E. Ritter met the crew in the field. The first time, in the middle of February, was to demonstrate to the field personnel the method in which the transects should be established, surveyed, and familiarized them with the BLM site recording forms. The second field meeting was a recheck to see if problems had arisen in the interim.

Dr. Roske made prior telephone contact with the Desert Planning Unit, then during the summer visited their office to review the historical information available. This was part of a trip that he made into southern California to conduct historical research at various libraries which house documents relevant to the project area.

Through Jerry Gates, caretaker at the ZZYZX Research Center, information was obtained on access roads, potential site areas and historic data regarding the immediate area.

## Report Organization

For this inventory report, several specialists participated as consultants to provide background data that could be utilized for the interpretation and understanding of the location or distribution of historic and prehistoric sites. These background data include the sections on

history, geography and geomorphology, biota and ethnography. The bibliographic references consulted in the preparation of these sections are listed in the bibliography under the respective section title. The historic section bibliographic reference also includes footnotes for more specific referencing that were provided by Roske. The remainder of the bibliography contains all the bibliographic references utilized in the sections prepared by the Research Center staff, which is the body of this report, and one reference from the Appendices.

Section 6 contains the sampling design, the three stages of the design and their results. Two of these, Stage 1 and Stage 2, as well as the sampling design were previously submitted to the COAR. In the initial analysis Miller used transect records from Stage 1, and where unworked flakes were noted she considered this as evidence of a site. Consequently, Miller has listed in her conclusions a total of 166 historic and prehistoric sites, since she considered isolated unworked flakes cultural evidence of prehistoric activity. In the discussion of site occurrence by transect, isolate sites are used as a concordance factor, as well as in the correlations of the site frequency by geomorphic locale (p.132 ff.) none of the isolated sites are considered in the other analyses.

The authors wish to thank Clinton E. Stay, Sr. and Evelyn Stay Moden of Las Vegas, Nevada for funding the typing of this manuscript for publication through a private donation.

Typical topography of the Owlshead/Amargosa Planning units. This view is from the northern Avawatz Mountains looking into Death Valley to the east. Photo by Russell L. Kaldenberg, July 1980.

# SECTION 1

## HISTORICAL BACKGROUND OF OWLSHEAD/AMARGOSA-MOJAVE BASIN DESERT PLANNING UNITS

For hundreds of years, before the first European contact, there existed a network of trails that linked waterholes in the western end of the Mojave Desert. The Indian commercial traffic passed through the various Mohave settlements of the eastern desert. This relatively waterless desert crossing evolved into two main routes: one by way of Pah Ute Creek and Rock Spring to Soda Springs, that in contact times became known as the Mohave Trail. The other route, the "Pah-Ute" route, ran south of the first trail through Foshay Pass and then to the north of the Kelso Dunes, where it joined the flood plain of the Mojave River about Soda Lake's southeast corner.

The Mohave trail spanned 270 miles between Needles and Los Angeles Mission San Gabriel. Colorado River Indians, particularly the Mohave, used the route named for them in pre-contact times as a trading trail across the territory of the Chemehuevi to the southern California coast. This network of the Mohave permitted them to trade for baskets with many groups; allowed them to get steatite from the far-off coastal Chumash; to obtain chicken hawk and eagle down from Chemehuevi; and rabbit skin blankets were bartered from the Paiutes. For their part in the trade the Mohave principally bartered for pottery, beadwork, and gourds. With the introduction of the horse by the Spaniards in the sixteenth century, the Mohaves became notable horse traders and thieves, driving horses east and west over the Mohave Trail to eager Indian purchasers.[1] The original Mohave Trail became in the nineteenth century (with variations), the Fort Mohave Government Road.

The prehistorical trails had considerable impact upon the events of the historical period, and as a result a look at the route and its commerce is in order.

### Explorers

The initial Spanish entrada occurred far to the south of the study area in the region of the Yuma crossing. In January, 1774, the Spaniards, hoping to create a land link between the struggling California settlements and the older, established cities and towns of Mexico, sent Captain Juan Bautista de Anza on an expedition accompanied by Father Francisco Tomas Hermenegildo Garces, who served as a guide.[2]

The trek of Garces and Anza in the fall of 1775 had a more immediate impact for the planning units area. This

party consisted of California-bound settlers, except for Anza's military escort and the Franciscan missionaries, a total of 240 persons. Garces again served as guide for the party to Yuma, where the priest accompanied by Indian companions left the main group. Garces and his companions traveled north from the Yuma crossing on the Colorado River, reaching the main Mohave villages in the Needles area. Garces left there for the west guided by experienced Indian travelers. While the major Mohave trail may have been located south of the route he then took, it seems likely the guides used it because the northern variant afforded better water and pasturage.

To the best of existing documentary knowledge, Garces crossed Paiute Wash, now the site of the Klinefelter Springs, traversed Foshay Pass in the Providence Mountains, skirted the Kelso Dunes near modern Flynn, to a spot on the western shore of dry Soda Lake near Soda Springs. From Soda Springs, Garces became the first known European to travel the Mohave Trail. It paralleled the Mojave River from the Cady Mountains southwesterly to the southern edge of the Calico Mountains, passing near modern Yermo and Barstow. Garces followed the Mojave River along its southern course to the foothills of the San Bernardino Mountaíns, where he followed Sawpit Canyon to the summit. He was able to descend the range's northern slope by a ridge to the west of Devil Canyon, and went on to San Gabriel Mission.

After resting and obtaining fresh supplies, together with Indian guides Garces began the return part of his trip. Leaving through Cajon Pass his party followed essentially the Mohave Trail to Yermo and then retraced its steps to Soda Lake.

There Garces altered his course to a more northern route that brought him to Indian Creek, Willow Wash and to Marl Springs. Then Garces went to Kelso Wash and the Mid Hills, continuing across Lanfair Valley to Paiute Creek. At Paiute Creek Garces turned north-northeast along the creek to Klinefelter Spring, where he rejoined his previous westward track. He left California north of Needles upon his way to Tubac in Arizona.[3]

Because of the hostile incursion of the Mohave Indians into coastal California, late in 1819 Spanish Lieutenant Gabriel Moraga led a military force to fight them. His force descended the Mojave River and then proceeded eastward into the waterless desert. He went a full days travel beyond Soda Lake (the Mojave Sink) before turning back because he had run dangerously low on food and water.[4]

Between 1826-1831, American Mountain men, fur trappers, traveled through the study area many times. The first of

these was Jedediah Smith who established a trail between Needles and Los Angeles. Seeking both furs and new trade opportunities, Smith and a party left northern Utah in the summer of 1826, and traveling through southern Utah, Nevada and northern Arizona reached the east bank of the Colorado near the present locale of Needles. Engaging two Indians to guide his party, Smith went westward along the long traveled Mohave Trail, stopping the first night (November 10) at Paiute Spring after crossing the edge of the Dead Mountains. The second night (November 11) he stopped at Vontrigger Spring. Then, he and his party moved west and a little north, camping in the Providence Mountains at a spring which has never been conclusively identified on November 12. The next days trek (November 13) was relatively short and led across Kelso Wash to Marl Springs. The party marched between Kelso Peak and Old Dad Mountains to Soda Lake's northern edge by the night of November 14. Then, having discovered the Mojave's mouth, the group pressed up what Smith would dub the "Inconstant River" to the usual camping spot beyond Soda Lake, about the present site of Afton. On the night of the 15th Smith's party stayed with the Mojave River, eventually reaching the site of Victorville. Apparently Smith did not use Cajon Pass in 1826, but ascended Sawpit Canyon and traversed Devil's Canyon, and then San Bernardino Valley. He pushed on, eventually reaching San Gabriel Mission. His party's reception by the Mexicans was hostile. After suffering a brief imprisonment he returned to the fur trappers rendevous by way of central California and central Nevada, far to the north of the study area, in mid-June, 1827.[5]

Undaunted, Smith planned a new foray and, taking much the same route as the year before, came down the Colorado River to the Needles area in the summer of 1827. In 1827 the Mohaves became hostile and turned on Smith while his party was crossing the Colorado River, killing ten of his men. Smith had not known it, but a trapping party under mountain man James Ohio Pattie had, between Smith's two visits, entered the area and wantonly killed one of the Mohave chiefs. The Indians retaliated against Smith. Losing much of his supplies and equipment, Smith and eight survivors successfully fought off the Indians and plunged on foot into the Mojave Desert. This time Smith had no Indian guides, but he drew upon his experiences the year before to survive. In 1827 his trip was much more hurried, as he in just nine and a half days, on foot, covered the distance between the Colorado and San Bernardino, which had taken him fifteen days on horseback the year before. His first camp was located at the same place as the year before, Paiute Spring. This time Smith took a more northerly track after leaving this waterhole. He found his way to Rock Spring, covering in two days nearly the distance of three days travel in 1826. From Rock Spring he led his party west to Marl Springs where he had

previously camped in 1826. Then, heading south and west, he passed below Kelso Peak and into the Devil's Playground reaching the north edge of Soda Lake where he made his fourth camp. Recognizing his former track he went west to the Afton area near Cave Mountain. Then he followed the trail of his previous trip up the Mojave River. Departing from his previous track, he used Cajon Pass, which he called the "Gape of the Mountains," to travel into coastal California. Smith had renewed interest in the Mohave Trail for non-Indian travel, which had originally been sparked by Garces in the 1770s.[6]

In the years immediately after Jedediah Smith's visit, there was a steady stream of other Americans to California by way of the Mohave Indian Trail. Some of them stayed in California and married into prominent California families; others returned east to spread descriptions of California. Among these early American Mojave Desert travelers was George C. Yount and William Wolfskill, Ewing Young and Kit Carson.[7]

Although the Spaniards had been interested in linking their New Mexico colonies with the California settlements, they never did so. After Mexico succeeded Spain as the claimant of the Southwest with the coming of Mexican independence in 1822, the link to California was finally accomplished by merchant Antonio Armijo in 1829-1830. Armijo traveled a most roundabout route. Because of northern Arizona's rough country and the more dangerous Arizona Indians, the Armijo expedition headed northwest from New Mexico into central and then southern Utah and southern Nevada. Then they descended the Colorado River to the Needles area and turned west following the tracks of Garces and Smith to the Los Angeles region.

Although it is certain that Armijo did not take the route of the old Spanish Trail through Las Vegas, Nevada, that northern route of the Mohave Trail has been accepted for years as the way later travelers from New Mexico normally went in the 1830s and 1840s.[8] Yet, in recent years, this conclusion has seriously been challenged by two historians, Elizabeth Warren[9] and Dennis Casebier[10].

The previously established version claimed that the trail veered from Utah, crossed the Virgin Route and then ran to Las Vegas. From there it proceeded to Cottonwood Springs, Mountain Springs, Resting Springs, and down the Amargosa River to Salt Springs, Bitter Springs and then over to the Mojave River. This northern route was the way John C. Fremont crossed the desert in 1844, and he highly publicized his track. Also, after 1848, the year America gained title to the Southwest, this road became the route of the Salt Lake to Los Angeles wagon way called the Mormon Trail.

According to Warren and Casebier this version of the old Spanish Trail remained in the 1830s and early 1840s a minor variant taken mostly by rustlers and bandits, rather than merchant caravans. These caravans may have journeyed south through southern Nevada, entering the area of modern California through a north-south valley, such as Pah-Ute Valley. The caravans could have followed Smith and Garces' tracks, with minor variations, along the Mohave Indian trail to the Mojave River.[11]

A New Mexican merchant, Francois X. Aubry, in late 1852 and early 1853 drove sheep from New Mexico to California by way of Fort Yuma, on his return trip sought the best route for a trans-Pacific railroad. Leaving the San Francisco Bay area in June 1853, Aubry with 19 companions mounted on horses and mules reached Tejon Pass north of Los Angeles and then headed east. He followed the Mojave River for 38 miles before angling off to the northeast on a variant of the Old Spanish Trail. His notes are so imprecise that there is the possibility that he went through the northern edge of the study area. In late 1853 he repeated his sheep driving trip from New Mexico to California and, heading northeasterly from the Mojave River, returned by about the same route as before. In 1854, he tried to find a spot on the Colorado some 50 miles below his 1853 fording of the river, so he may have been south of his earlier (1853) track and within the northern edge of the study area. Unfortunately, before Aubry could better organize his sparse travel notes after his return, he was fatally stabbed in a brawl at Santa Fe.[12]

Between Aubry's two trips of 1853 and 1854, the study area was entered from the west late in 1853 by a member of the army's topographical corps; Lieutenant Robert Stockton Williamson leading the expedition. He was accompanied by several scientists and other civilian employees, together with a small cavalry escort commanded by Lieutenant George Stoneman. The expedition's purpose was the discovery of the most practical railroad route through California.

In early October, 1853, Williamson's party traveled southward from his explorations of Tejon Pass and the Canyon de las Uvas. Meanwhile, a sub-group under Lieutenant Parke traversed the San Fernando Pass and the San Gabriel and Santa Ana Valleys. By the middle of October the reunited parties made camp on the Mojave River. Williamson from this base dispatched Lieutenant Parke to follow the Mojave River to discover if there were a good pass at its end. He followed the river and beyond for one hundred miles. Williamson himself studied the course of the Mojave River as far as the place in the canyon where the road left the stream. Breaking into two sub-groups they moved westward outside the Mojave Desert.[13]

Also entering the study area in the late winter of

1854, was another young topographical corps officer, Lieutenant Amiel Weeks Whipple, who led an expedition consisting of ten technicians, plus a military escort of 70 men. This party left the Canadian River in modern Oklahoma and marched as far as Albuquerque, New Mexico, territory. From there the party moved west to the Colorado at Bill Williams Fork. Then Whipple's party turned north on the Colorado to Needles. There the expedition followed Smith and Garces' tracks (the Mohave Indian Trail) to the west as far as the Mojave River, Whipple giving what proved to be permanent names to several geographical features, including Soda Lake. This railroad surveying expedition followed the Mojave River as far as the wagon road to San Bernardino that branched off at Oro Grande to the southwest.[14]

The unofficial explorations of Aubry, and the two official expeditions of Williamson and Whipple, resulted in the accumulation of a large body of geographical information about railroad geography, but the area needed further scientific study before it would be ready for settlement. The federal General Land Office contracted with private firms, called deputy surveyors, to fix the township lines and to subdivide these townships. Contracts were let between 1854 and 1856, with the actual field surveys being made from 1855 to 1857. The surveyors wandered over the Mojave Desert setting their markers. The work was hastily, often poorly, done. As a result, their monuments and markers could often not be located later.[15]

By the late 1850s, American public interest turned to postal routes and wagon routes. Congress appropriated money to survey and to improve the Government Road or, as it also became known, the Thirty-Fifth Parallel route, between 1857 to 1860. The western portion of this road ran across the Mojave Desert through the study area.

On June 1857, Edward F. Beale led an expedition from Texas with the purpose of surveying a wagon road to California and testing the usefulness of 25 camels on the American desert. After leaving El Paso they followed the earlier track of Lieutenant Whipple's route to the northwest. By mid-October 1857 the party had reached the Colorado River fifteen miles north of the present city of Needles, California, after surveying a wagon road from Fort Defiance. Unhappily, Beale did not record his track across the Mojave Desert to Fort Tejon. In his report he only said that he followed "the United States surveyor's trail from the river to Los Angeles."

After spending only a few weeks in Los Angeles, on January 6, 1858, Beale took fourteen camels and twenty men over the return road in winter. He crossed the Mojave Desert, presumably over the trail of the same name, reaching the Colorado River in January, 1858. Here he happened to meet

Captain George Alonso Johnson who, with his steamer the General Jessup, had journeyed up river. Johnson ferried Beale's expedition safely across the river, and they moved on eastward.

On October 28, 1858, Beale in a return trip headed west from Fort Smith, Arkansas. Running into cold weather he and his party wintered in New Mexico. In the late winter he again started west, reaching Albuquerque on March 3, 1854. On April 18, 1859, Beale met a relief expedition with additional supplies near the modern city of Flagstaff, Arizona. Beale's party camped on the west bank of the Colorado River. His party spent two months improving the road through western Arizona. Finishing this task, by the early summer he marched his column over the familiar Mohave Indian Route, across the Mojave Desert to Fort Tejon in the Los Angeles area. Then Beale returned east, leaving on July 2, 1859, from the Los Angeles region, and twenty-seven days later reached Albuquerque. Thus Beale had conducted his surveys while also attempting an experiment in the use of camels on the American desert.[16]

Since Beale's work on the Government Road was well covered in the eastern newspapers, emigrants attempted to utilize the trail, only to be turned back by a Mohave attack in August, 1858. Also, a westbound mail route from Kansas City, Missouri to Stockton, California had its riders harassed by the Mohaves.[17]

The Mohaves, together with their fellow riverine peoples the Kamia and Yuma, were the only California Indians to develop a tribal organization larger than a village. Steady pressure from the nomadic southwestern people forced the Mohave Indians to unite for protection. Also, this pressure fostered the development of warlike values in Mohave culture. The harsh desert environment also pushed the Mohaves to develop a limited type of agriculture. Because of these facts, the Mohave Indians are sometimes not regarded as one of the pacifistic groups of California Indians.[18] The Mohaves had been hostile to the white intruders at least as far back as 1827, when James Ohio Pattie's party had outraged them by killing one of their chiefs.[19] It seems unlikely that any agitation by the Mormons at the time of the 1857 occupation of Utah by the federal army of Albert Sidney Johnston inspired the Mohave's warlike attitude. It may have been their desire to control and exploit American travelers, as they had the Spaniards and Mexicans.[20]

In December, 1858, Major William Hoffman with a company of dragoons rode from Los Angeles to the Colorado River to reconnoiter the country around Beale's crossing fifteen miles north of Needles. The exuberant Mohaves, flushed with success after repelling the emigrants, harassed the cavalry column. Then, on January 9, 1859,

the Indians forced a brief skirmish in which they lost about ten warriors. Hoffman prudently retreated to the Los Angeles area for reinforcements. Hoffman was reinforced by six companies of infantry. Two companies of infantry marched overland and rendezvoused with the rest of the expedition, who came by water to Fort Yuma. In April, 1859, the whole force, over seven hundred strong, marched northward. This force comprised about half the size of the entire Mohave nation. The Indians were so impressed by it that they surrendered. To hold the Mohaves in check, the troops built Fort Mohave on the eastern bank of the river. Two companies of infantry, and some artillery, garrisoned it.[21] As a result of the fort's establishment, the old Mohave Indian trail became a wagon road, crossing the Mojave Desert by way of the study area, hauling supplies from Los Angeles to the fortification.[22] The Mohave Road continued its importance until the railroad from Los Angeles by way of Daggett to Needles captured the passenger traffic in the 1880s. Then the Mohave road lost travelers who preferred the railroad line. Water could always be procured from the railroad's water tanks. Also, traffic north or south could go from the railroad stations.[23]

The still important wagon route was protected in the late 1850s and early 1860s by a series of miliary outposts along its course. The army founded Camp Sugar Loaf (near Barstow) in 1858; Fort Beale in 1859; Camp Cady in 1860; Camp Marl in 1865; Camp Rock Spring in 1866 and Fort Soda in 1866.[24]

This fort building was sparked by an incident in the early 1860s along the Salt Lake Wagon Road, basically the Old Spanish Trail, when Indians whose identity was never discovered had killed three white men. The army sent an expedition led by Major James H. Carleton to punish the offending Indians, who were supposed to be Paiutes. Carleton's dragoons passed through the study area, although his largest battle, Kelso Dunes, occurred outside the study area. Although Carleton's foray was successful, it did not lessen Indian hostility.[25] Especially after the Civil War began, and the regular troops were withdrawn to the east, small parties of whites were regularly harassed by the Indians.[26]

As a result, in 1866-1868 when the Arizona overland mail was carried over the Government/Mohave Road, the army authorities established protecting relay forts, including one at the former outpost in the study area at Soda Springs. It was composed of rough and unelaborate stone structures. It was abandoned after a year's occupation, when the military imposed a peace on the Indians.[27]

Mining

By 1863 the mining phase of eastern San Bernardino

County's history had begun. Up to this time the American impact upon this area was small. Away from the principal roads and trails, and the scattered forts, life had gone on much as before white contact.

In the 1860s mining dominated the area's economy, although this area's mines were isolated without railroad transportation. Yet indigent prospectors stimulated by the Nevada Comstock discovery of 1859 searched to find rich ores that they could sell to investors financially able to develop them. By the 1870s the pattern had shifted, and small operators tried unsuccessfully to compete with the larger corporations who had entered the field. The greatest problem throughout the period 1860-1880 was the area's isolation and the consequent high cost of transportation.[28]

Rock Springs Mining District

The first mining occurred in the desert east of the Rock Springs Mining District, which experienced a burst of activity between 1863-1866. Small amounts of gold and silver were mined and sent to San Francisco mills. The ore mined was of the sample variety in an attempt to obtain financial backing for a more serious effort to mine.[29]

Clark Mining District

Far to the east of the study area in the Clark Mining District located to the east of the Clark Mountains, Ivanpah (site I) became the center of this activity mining precious metals (gold). Mining operations continued intermittently at this site until the 1930s.[30]

Calico District

As a result, hopeful prospectors fanned out over the San Bernardino County desert lands, including the study area. This activity resulted in a silver strike as early as 1874 in the Calico District west of the study region.[31] Indeed, during the ten years from 1863 to 1873 Wells Fargo Company alone shipped bullion worth $115,000 from San Bernardino.[32]

Avawatz District

This strike led to mining activity in the study area as well. The Avawatz mountains, a high range in San Bernardino County, had a northern slope which was the site of one of the earliest gold mines in California, the Amargosa. This mine possessed a mill as early as 1856, but apparently the ore soon played out. Busy prospectors in the late nineteenth century found native silver ore mixed with the gold. Soon arastras to crush the ore dotted the mountains landscape. Ultimate success eluded

those mines, because the deposits proved to be superficial.[33]

Palms Mining District

Far to the south of the study area mining activity also began. The water available at Twenty-Nine Palms caused it to become a mining base camp for the Palms Mining District. Early in 1873 several mines were filed on likely-looking lodes. The most productive and largest mine in the district was J. Voshay's Blue Jay, located at Township 2N, Range 9E, of the San Bernardino baseline and meridian. Nonetheless, all these early claims soon played out, and the Palm District grew quiet.[34]

In the 1880s, when the Santa Fe Railroad was constructed through the Mojave Desert, its previous isolation vanished. The railroad managers quickly realized the need to complement their cross country traffic with local freight and passenger business. This realization meant encouraging mining in the lightly populated desert areas. A wagon road was built parallel to the railroad tracks, and at stations supplies and water were made available to prospectors.[35]

As a result of this stimulus, on the western edge of the study area about 35 miles northeast of Daggett, the Alvord District was created in 1885 located in Sections 1, 2, and 12, Township 11N, Range 3E, San Bernardino meridian.[36] The Alvord mine had been active periodically from 1885 to 1870.

Similarly, in the Twenty-Nine Palms area mining activity increased after 1883. Lew Curtis, a prospector, discovered placer gold in the high ground to the east. Another miner, John Burt, had successful diggings on the shores of a dry lake which bore his name. This lake was later called Dale. Particularly, in the north end of the Pinto Basin, dry placer mining was employed to separate gold from the caliche. A dry lake nearly 15 miles east of Twenty-Nine Palms and approximately 6 miles north of the dry placer diggings became the scene of an arastra, which was built because a well could be dug there. The arastra milled the districts ore. A town named Virginia Dale sprang up there. The origin of the settlements name is unknown.

The first large mine in the district was located on the west slope of Black Mountains. Although the ore was only medium or low grade, in 1885 two prospectors filed claims for a mine called Virginia Dale called after the town. In time the Virginia Dale consisted of 6 claims, at an elevation of 2000 ft. The original two prospectors, Johnny Wilson and Tom Lyons formed the Virginia Dale Mining Company. At first results were disappointing, and so in 1889 operations ceased. The original prospectors then sold out, and one owner after another bought in and quickly sold out. In 1923 a period of operation ended suddenly. In the 1930s the price of gold

permitted the use of improved milling machinery, and some activity resulted at the Virginia Dale.

After the discovery of the Virginia Dale mine, it was not long before other mines were also operating in the area. This activity persisted, despite the fact that Dale was perhaps the most isolated of all the districts in southern California. The only wagon trail of any economic importance in the district was the route to the Colorado River, blazed by the old mountain men, and a miner with the improbable name of Pauline Weaver. For his own purpose he kept the trail a secret for a time. It is conjectured that the Morongo Indians showed it to him. The road ran up the Morongo Valley to Yucca Valley and then on to Twenty-Nine Palms. From there it passed through the site of the modern community of Rice, ending at the Colorado River opposite the mouth of Bill Williams River. Present day California 62 follows much of this route. Also, during the time that Dale existed, there were three consecutive camp sites. For example, the Virginia Dale camp and mine were actually the second Dale townsite. The second camp lasted the longest, from about 1886 to 1917, when the restrictions of World War I aided in the demise of the second mining effort.

South of the Virginia Dale mine was the claim called the Supply Mine. During the course of its operation this claim produced millions in gold and caused one of the relocations of the Dale camp. It is located at Sections 21, 22, 27, and 28, Township 18, Range 12E of the San Bernardino base and meridian. The claim had a sister claim, the OK or Storm King Consolidated, located at Section 35, Township 1S, Range 12E on the San Bernardino baseline and meridian. No records exist to verify who discovered these claims. About 1900 the two mines belonged to a corporation called Seal of Gold. This company built an excellent ten-stamp mill and a shaft to a depth of 600 ft. The Supply Mine, which had richer ore bodies, was not so well equipped, as it had only three two-stamp batteries in its refinery mill. From the edge of Dale Dry Lake water was piped to both holdings.

Around 1908 the Seal of Gold partnership dissolved and litigation engulfed the new owners. In 1909 operations proceeded for a short time under court approved leases. The lawsuits were finally settled, and the United Greenwater combine took control in 1914. For three years, under all sorts of difficulties for the United Greenwater Company, the mine yielded almost one million dollars. One of the original Seal of Gold operators, H. A. Landwehr, then operated it, expanding the holdings. As late as 1931 California's division of mines reported the Supply Mine to comprise some nine claims of patents at the height of 2300 ft on Dale Hill's west slope.[37]

Operated without any close ties in the western district,

except for water supply, was the Brooklyn mine. It was located in Section 36, Township 1S, Range 1E, on the San Bernardino base and meridian. This gold containing vein was originally found in 1893. A corporation, the Brooklyn Mining Company, worked it from 1901 to 1918. Then its operations continued intermittantly between 1916 and 1930, together with an adjoining mine, the Los Angeles. Before 1930 the Brooklyn output was $150,000. During the 1930s, after a break in operations for the worst of the depression, the output of both mines was worth only $13,000.[38]

Halloran Springs District

In the 1890s the Halloran Springs District, 12 miles to the northeast of Baker, was prospected for gold. The prospectors found ancient artifacts there, which indicated that turquoise had been mined in this area in prehistoric times. The best producer of the district was the Telegraph Mine, which was not found until 1930. This mine is located in Sections 16, 17, and 20, Township 15N, Range 11E of San Bernardino base and meridian. Its total output to 1952 approximated $100,000.[39]

Old Dad Mining District

On the eastern edge of the study district are the Old Dad Mountains, twelve miles east of Baker. Gold was discovered here in the 1890s. Later, there was considerable activity by the unemployed miners in the 1930s and 1940s. Some mining activity persisted down to 1970. Among the biggest producing mines was the Paymaster (Whitney) Mine. Its locations is Sections 22 and 23, Township 13N, Range 10E, of the San Bernardino base and meridian. In somewhat over fifty-two years, between 1900-1952, it yielded $50,000 to $100,000 in gold. By 1952 the working crew had dropped to three men.[40] Another large producer was the Brannigan Mine, located at Sections 26 and 27, Township 13N, Range 10E, San Bernardino base and meridian. Claims were filed in the mine area as early as 1905, but shipments of ore were restricted to 1928-1935. In that period it yielded several thousand tons of gold ore.[41] Among other gold producers in this area is the Oro Fino, located at Sections 23, 26, Township 13N, Range 10E, of the San Bernardino base and meridian. This area prospered in the 1890s, but the period of greatest activity was 1930-1945.[42]

Stedman/Rochester/Buckeye District

One of the most important gold mining districts from the standpoint of sustained outside interest by investors is the Stedman, or as it also has been known, the Rochester or Buckeye District. This district lies in the north central part of San Bernardino County, eight miles south of Ludlow.[43] In the 1880s this area became known as the Rochester district

because of an ore discovery by John Suter, an Atlantic Pacific (forerunner of the Santa Fe) roadmaster, who filed claim to the area 8 miles south of Ludlow. The district's principal mine was located at Sections 7 and 8, Township 6N, Range 8E, San Bernardino base and meridian.[44]

The Bagdad-Chase

This mine yielded more gold and copper than any other mine in San Bernardino County. Between 1904-1952 the mine produced more than $6,000,000, or over half the recorded gold mining, by value in the county since 1880.[45]

In 1900 John Suter & Co. developed the district. However, Suter became discouraged and sold out in early 1901 to prominent buyers associated with the ownership of the New York Central Railroad. These leading money men organized a new company, the Bagdad Mining and Milling Company, to exploit these holdings. As a result of lack of water at the site, the investors decided to use the milling facilities at Barstow. Related to this milling decision, they had to build a feeder railroad from the mine to the Santa Fe tracks at Ludlow, so the main railroad line could then deliver the ore to Barstow. In July, 1902, the Ludlow and Southern Railway was incorporated, and a contract signed to build its tracks,[46] which ran after completion 7½ miles to Ludlow.[47] Meanwhile, the Bagdad Corporation filed many additional claims in the area.[48]

A mine near the Bagdad owned by John R. Gentry was also acquired. As a result, between 1902-1904, the Gentry, Bagdad, and the neighboring Roosevelt Mine were amalgamated and worked as one giant operation, the Bagdad-Chase Mining Company. Meanwhile, the feeder railroad was completed after eight months of sustained effort in early 1903 at a cost of $80,000.[49]

Between 1904 to 1910 the mines yielded 150,000 tons of ore which was treated at Barstow.[50] From 1910 to 1916 the Pacific Mines Corporation operated the mines. By 1916 the leading investor John Hays Hammond withdrew, as he became interested in petroleum development. Declining yield at the Bagdad-Chase holding also caused investment interest to shift, and the property passed into the hands of receivers.[51] By 1916 the Ludlow & Southern, because of declining traffic, ceased operations. By the summer of 1935 much of its track was taken up (See Railroad section for further details). Between 1916-1932 sublease operators occasionally worked the mine without much success.[52] Then, in 1938, a group of investors known as the D'aix Syndicate operated this mine for twelve months in 1938-1939, producing 850 tons of ore, averaging $980 per ton in gold.[53] Because of the money problems created by the outbreak of World War II these investors withdrew from the exploration of mines. Between 1940-1954 various leasees worked the property, until the later date when all operations were shut down because of

rising costs and declining yield.[54] It was still closed 8 years later in 1962.[55]

Avawatz District (20th Century)

In the north of the area, the Avawatz Mountain region saw a new burst of energy in the twentieth century, about 1910, in the mine located in Section 26, Township 16N, Range 6E, San Bernardino base and meridian. Avawatz Crown Mine properties were developed by a Los Angeles group of investors. Their operations involved largely the surface deposits, although one shaft was sunk to a vein. In all, some 84 ounces of silver was recovered. However, since the world price was only 42 cents an ounce, the mine did not warrant further exploitation of its resources.

Alvin B. Carpenter, a Los Angeles mining engineer, was consulted by the owner corporation, Crown Company. He became so smitten with the mine's prospects that he took an option on it himself. In the latter part of 1917 a considerable strike of lead-silver ore led to a rush of prospectors to the area. Yet it was difficult to raise large sums of mining capital because of World War I. Consequently, nothing further was accomplished at the mine site. In May 1919, the Avawatz Consolidated Mines took over the property from the former Crown Company. The Tonopah & Tidewater Railroad ran nearby, and the mine was linked to it by an eleven mile long wagon road. The high hopes of the Avawatz Consolidated investors in their lead-silver ore was never realized, although as late as 1943 Avawatz Consolidated Mines Company of Los Angeles purchased the property.[56]

In all, the peak of San Bernardino's precious metals mining ran from 1883 through 1888 and from 1901 to 1906, 1913-1917, 1921-1928, 1934-1942. Also helpful to San Bernardino's economy was the mining of copper starting 1888-1900. Copper was important as a mining product in 1912, and then throughout the World War I period. It remained at a low level during the Great Depression, and even World War II stimulated its mining only mildly.[57] After World War II there continued to be some sporadic mining for construction and other industrial materials. For example, a prosaic material, such as cinders, was quarried from the Lava Flow area and cinder cones region located southeast of Baker.[58]

Mining in the study area, as in mining generally, is not entirely governed by rich veins and worthwhile ores, but is also the result of world demand based on existing economic conditions. Thus, prosperity or failure is less the result of miners efforts and more a result of the world economy. It is noteworthy that as recently as 1977 only 711 persons were employed by mining enterprises in all of San Bernardino County.[59]

## Railroads

Long before the United States took possession of the Pacific Coast region, it was already interested in a transcontinental railroad as a trade route to the Orient. Therefore, after the conclusion of the Mexican War, when the United States obtained California and the Southwest, interest in a Pacific railroad soared.

The only seriously inhibiting factor was the controversy over which exact railroad routes was best. The two sections, the North and the South of the United States fast dividing in those pre-Civil War years, quarreled over the best route, considering that each placed its own sectional needs uppermost.[60] The Thirty-Fifth Parallel Route for the railroad had its feasibility demonstrated in the 1850s by various explorers. Yet it remained unbuilt for two reasons. First, it ran through Mohave Indian country, and until those warlike Indians were subdued (as they were by Major Hoffman in 1859-1860) it could not be constructed. Second, after the Mohaves were conquered, the North and South had split too far apart to agree on any proposed route of the transcontinental railroad.[61]

Of the various railroad surveys, Lieutenant Whipple's was the most thorough study of the project area. Early in 1854, with his survey party guided by Mohave Indians, he took a path that was a variant of the Mohave Trail. Since this trail crossed high, rugged mountains, it was clearly not the best line for a railroad. A railroad line built farther south could avoid the mountains, and so be constructed across level ground.[62]

After the Civil War closed, in 1868 a railroad surveyor, General William Jackson Palmer, in the employ of the eastern division of the Union Pacific Railroad, traveled a route through the Mojave Desert, avoiding the mountains and following a line approximately south of the Old Mohave Road. It ran from Needles to Daggett. A railroad was not immediately built as a result of Palmer's survey, but in 1883 one was finished that substantially utilized his route, the Santa Fe Railroad of today.[63]

## The Atlantic and Pacific Railroad

The construction story of this line began when Congress chartered the Atlantic and Pacific Railroad on July 27, 1866. The line was designed to run from Springfield, Missouri, to the Pacific Ocean. Another section of the enabling act, however, authorized the Southern Pacific Railroad to build south from the San Francisco Bay area to meet the Atlantic and Pacific on the eastern border of California. The seeds of dissention were sown by this arrangement.[64]

The A & P stalled about 327 miles from St. Louis while crossing the Indian territory (modern Oklahoma). Adverse financial conditions forced a reorganization to a new company, the St. Louis and San Francisco Railroad Company. This new corporation acquired the existing track and franchise, as well as the congressional land grants of the former company. The underfinanced new company was soon in trouble. The large investors of the Atchinson, Topeka & Santa Fe Railroad, which desperately wanted a California outlet, entered into negotiations with the financially troubled S.L. and S.F. Two complicated arrangements were concluded on January 31, 1880. The first agreement split the A & P stock in half, giving the Santa Fe and the S.F. & S.L. equal holdings. With joint control assured, an agreement was negotiated between the two parent railroads and their joint subsidiary. The three agreed to build the western division of the Santa Fe from Isleta, near Albuquerque, to the Pacific Ocean. The S.L. & S.F. would provide the eastern terminus in St. Louis which the Santa Fe then lacked.[65]

Work on the junction point, Isleta, was begun in earnest by the spring of 1880. By the end of 1881, 190 miles of track had been laid from Isleta to a point 360 miles from the California border. At that point work stalled because California financial interests obstructed the building of the Santa Fe to the west.[66]

The California financial interests were obstructive, since the "Big-Four" owners of the Central Pacific Railroad (completed with a trans-continental connection in 1869) had insufficient business to earn a profit.[67]

The Central Pacific had built down the then sparsely settled San Joaquin Valley. The Central Pacific, even after the company reorganized as the Southern Pacific, built its track through the Tehachapi Pass to Mohave and Los Angeles.[68] From those places it pushed to Yuma, Arizona, to meet the Texas & Pacific then building west from the Lone Star State. To its consternation, it found that the Texas & Pacific's construction had stalled deep in Texas. As a result, the management of the Southern Pacific built eastward, beyond El Paso, before it finally linked with the T & P. The noted financier, Jay Gould, controlling the T & P, drew up a close association with the S.P. by a new agreement. With the control of both a northern and southern route, the S.P. did not want competition from the A & P. To forestall this dreaded competition the S.P. obtained seats on the S.L. & S.F. board of directors. In this position they made so much mischief that the Santa Fe could not build its line beyond Needles on the west bank of the Colorado River.[69] Meanwhile, to beat the Santa Fe, the S.P. began to build eastward from Mohave. The S.P. built so quickly that by the close of 1882 its tracks stretched beyond Ludlow. At last, on April 19, 1883, the railroad reached Needles. Because of difficulties in

bridging the Colorado, the actual linking of the tracks of the S.P. and the Santa Fe did not happen until August, 1883.[70]

Since the S.P. and A & P did not cooperate in their operations, passenger travel from California to Albuquerque through Needles was light.[71] Finding the situation intolerable the A & P planned to build its own line to the Pacific. At this time S.P. management had second thoughts. Therefore, both railroads signed an agreement to take effect on October 1, 1884. Under the terms of the agreement the A & P brought the S.P. track from Mohave to Needles. Then, for the first time, the A & P operated as a through line.[72] Despite operational problems caused by steep grades, train wrecks and water problems, the A & P succeeded in reaching the major California ports by tying various short railroads together. On May, 1890, the Santa Fe succeeded in winning control of the S.L. & S.F., which also ended its problems of ascendency over the A & P.[73]

Yet the Santa Fe's troubles were far from over. The 1893 depression forced the Santa Fe and its two satellite roads, the A & P and the S.L. & S.F. into receivership.[74] After a welter of complicated legal maneuverings, the Santa Fe acquired the entire western division of the A & P, including the track from Albuquerque to Needles, in addition to the leased line of the S.P. between Needles and Mohave. Also, on the last day of June, 1897, the A & P ceased to exist and its property returned to the Santa Fe Pacific Railroad, a subsidiary company of the Santa Fe.[75] On July 1, 1902, the operations and title of the former A & P railroad were transferred to the parent company, the Santa Fe.[76] Finally, to tidy up the legal situation, on December 27, 1911 the lease of the Mohave-Needles track was changed, and title to that property was transferred to the Santa Fe which turned it over to a subsidiary.[77]

The Santa Fe continued to have operating problems. The railroad bridge over the Colorado proved to be inadequate, but, with strengthening, lasted until 1945, when it was replaced by another span. The single-track Mojave Desert section of the railroad proved inadequate and was gradually double-tracked, which improvement was not completed until 1923.[78] Mining activities in the desert and through inter-continental traffic finally, in the age of desiel, brought relative prosperity to the Santa Fe.[79]

<u>Santa Fe Feeder Lines</u>

The Santa Fe had three feeder lines of interest to this study. Interestingly, these feeder lines had a symbiotic relationship with their client mines. The mines made the railroads financially solvent by carrying the ore from the mines, which in turn might never have been developed without the railroad.

Amboy-Saltus Railroad

The first of three feeder lines of the Santa Fe is the Amboy-Saltus Railroad. Amboy was a station on the Santa Fe's main line, an equal distance between Needles and Barstow. It existed largely because a dry lake, Bristol, containing large deposits of gypsum and salt, lay to its south and east. Gypsum is used to make plaster of paris, wallboard and cement. It can also be employed to dress soil.

As early as 1904 the Pacific Cement Plaster Company constructed a mill in Amboy. To feed this mill the Pacific Cement laid a 1½ mile long narrow gauge track, mules were the motive power. In April, 1909, the mining property and railroad were purchased by the Consolidated Pacific Cement Plaster Company. About 1913 locomotives were substituted for mules, and the track relocated. The narrow gauge track was rebuilt in such a manner that it no longer ran straight south from Amboy, but rather it passed in a southeasterly direction, three miles to a new quarry site near Saltus. In 1916, a new mill was constructed near the middle of the short line, much closer to the gypsum deposits. The Santa Fe built a spur from its main line which, in February, 1917, was named Funston for the then recently deceased military hero, Frederick Funston.

Although the original mill at Amboy was closed, the railroad continued. The railroad acquired a new function, acting as a commuter train carrying mill workers to and from their Amboy homes. In September, 1919, the Arden Plaster Company bought the Amboy properties. Although the track from Funston to Amboy was abandoned, the remainder of the line continued. In 1924 Funston and Bristol Lake operations were closed down. As a result the Funston plant was closed and the railroad tracks taken up. The tracks were used to build a 1½ mile railway at Midland in Riverside County, where the Funston plant had been moved.[80]

Several companies staked claims to the Bristol Lake salt. The forerunner of the California Salt Company, the Capital Salt Company then operated a feeder railroad. Back in the 1880s Crystal Salt had operated a quarry at Danby Lake, southeast of Bristol Lake. At that time steam traction pulled wagonloads of salt to the A & P main line at Danby, thirty miles away. Most of the output was sent to Calico mills where it was used to reduce silver ores.

Calico's decline caused Crystal's operations to decrease. Yet, in 1909, Crystal Salt continued to produce salt, and in 1910 built a mill at Saltus on the Santa Fe main line and linked it to the lake bed by a narrow gauge railroad. The operation of this more elaborate property was not a financial success, and the Consumer's Salt Company took over control of the facilities. Trying to reach a financially sound basis,

Consumer's Salt built a new plant. In 1921 the facilities were leased to the California Rock Salt Company and production increased. In 1927 the California Rock Salt Company took title to its leased property. In 1950 the California Rock Salt Company shortened its name to California Salt Company.

With the coming of the early 1920s workers lived in sheet-iron shacks--too hot in summer and too cool in winter. Saddle tank locomotives hauled the small salt cars. In the late 1920s the last saddle tank locomotive wore out, and gasoline engines drove the trains.

During World War II a new plant was constructed at Saltus, causing the relocation of the Santa Fe's spur, as well as the narrow gauge track. Production grew because this quarry produced the salt for Basic Magnesium's plant at Henderson, Nevada. By the 1960s there were four Plymouth gasoline engines drawing trains of more than 20 cars of rock salt from quarry to mill over a track length of four miles. Production remained steady, and by the 1960s over two million tons of salt had been produced.[81]

Ludlow and Southern Railroad Company

Much has been said in this report already about the Ludlow and Southern Railway in discussing the Rochester (Buckeye) mining district. It was the second feeder railway for the Santa Fe.

This railroad was surveyed in May-July, 1902, and then was built after the contracts were let in July, 1902. Grading for the track was finished in November, 1902. By January-February 1903, ties arrived at the site of the railroad. By April, 1903, second hand rails were furnished by the Santa Fe. Track laying began in May and was finished over the 7½ mile length of the feeder railway.

The railroad was constructed from the Bagdad-Chase mine to Ludlow. From there gold and copper ore was transported via the Santa Fe to reduction mills at Barstow. Much of the rolling stock equipment of the Ludlow & Southern was second hand and obtained from the New York Central Railroad, through the financial ties between the directors of the two enterprises. Around 1910 the Tonopah & Tidewater (see later in this report) played a part in the L & S operations. In 1916 when the eminent mining engineer, John Hays Hammond, withdrew from the Bagdad-Chase operation in favor of petroleum exploration, development lagged. As a result, passenger traffic lagged and so the L & S curtailed its passenger operations, ceasing to be a common carrier.

In the latter part of 1932 while the railroad was inoperative, a disasterous fire in the engine house at

Rochester damaged the last operative locomotive. As a result, only a motor car ran over the tracks for some time. The railroad's tracks were laid in a gully, with the expectation of an occasional washout. But, in view of the lack of mining operations in 1932 when nearly a mile of track was destroyed by flood, it was never replaced. The entire track was taken up and sent to the Philippines. In 1937 the inoperative locomotives were cut up for scrap; in 1939 the last passenger coach was destroyed by fire. Thus, it is impossible to assign a definite date for the railroad's end.[81]

<u>The Salt Lake Route</u> (Union Pacific)

Although it was too long and important to be considered a mere feeder road, the Salt Lake Route needs to be discussed before the last real feeder, the Tonopah and Tidewater, can be considered. The importance of the Salt Lake Route is shown when its passenger service, ended by the formation of Amtrack, was restored in the fall of 1979. It was the only passenger service to be started at that time by Amtrack.[82]

The Union Pacific had long desired to complete the last significant gap in inter-continental railroads from Salt Lake City to Los Angeles.[83] Through an amalgamation, a small subsidiary corporation, the Oregon Short Line, of the U.P. began to build from Milford, Utah by late 1889. The work went on throughout most of 1890, but only the grading and the tunnels were finished. When the track laying machine began to operate, the precarious financial condition of the parent corporation forced a halt to construction activities.[84] Then, because of the Panic of 1893, the Oregon Short Line was sheared from the Union Pacific and the latter went into bankruptcy.[85] In 1893, the U.P. emerged from its financial problems under a strong leader, E. H. Harrigan, who succeeded in returning the Oregon Short Line to the control of the Union Pacific.[86]

Then in 1898 the Utah and Pacific was incorporated. That railroad announced that it would complete a 75 mile segment of track from Milford to Uvada, Utah. Then the U.P. signed an agreement with the Oregon Short Line which stipulated that the U.P. could use the uncompleted Oregon Short Line grade in Nevada in exchange for some Utah and Pacific land.

The U.P. began construction in the fall of 1898 and reached Uvada on the Utah-Nevada border. The U & P extended service into Nevada by July, 1899. From there the Oregon Short Line planned to build across the state of Nevada to California.[87]

Then William A. Clark, a copper king, entered the scene. He wished to construct his own line from Salt Lake City to

Los Angeles. Clark, in August, 1900, bought the California terminus of his proposed line, the Los Angeles Terminal Railroad. From the Utah end, he bought a "paper" railroad, the Utah & California. Clark used it as a vehicle for building his railroad by expanding its charter to build outside Utah.[88] In March, 1901, Clark purchased the Lincoln County rights to the Old Oregon Short Line grade. Lincoln County had seized title to the grade because of non-payment of local taxes. Thereupon, Clark incorporated his own San Pedro, Los Angeles & Salt Lake Railroad to serve as a vehicle for his Nevada construction. The vital area for railroad construction was Clover Valley, of which both Harrigan and Clark had maps to bolster their contentions that each had correct title.[89] Taking the case to the federal government, in April, 1901 after a four day hearing, the commissioners of the U.S. Land Office in Carson City upheld the Clark claim.[90] Vowing never to be beaten, Harrigan appealed the case to the General Land Office in Washington and dispatched a force of workers to continue his possession of the disputed railroad grade. Clark also sent strong men to defend his claims. The result was several clashes between the contending groups.[91]

On appeal the General Land Office overruled the Carson City official's decision and awarded the disputed right-of-way to Harrigan.[92] After further hand-to-hand fighting among the construction crews, a truce was patched up by mid-May, 1901. The issue was then thrown into the courts and while they deliberated the Clark and Harrigan forces built a vital passage through Meadow Valley Wash in Nevada. Then, in September, 1901, both groups suspended work. Construction was halted for 19 months while negotiations continued behind the scenes.[93]

On July 9, 1902, a compromise agreement was negotiated. This resulted in a joint Harrigan-Clark ownership of the Salt Lake route. When construction resumed, the two tycoons decided not to extend the Salt Lake route to the Southern Pacific at Banning, California, but instead to connect with the Santa Fe at Daggett. This decision saved both time and money.[94]

All during 1904 the construction work proceeded slowly. Finally, two work crews, one from the north and the other from the south, joined rails near Jean on the afternoon of January 30, 1905. Much secondary work remained to be accomplished, and the railroad did not open for regular business until May 1, 1905.[95]

The Salt Lake Route had hardly been finished when in the summer of 1905 severe flooding occurred. Then flooding in 1906 closed the line for three weeks. The year 1907 was

worse. In February a flood wrecked the Meadow Valley Wash tracks. At the western end of the line, in the Mojave Desert between Otis and Daggett, the grade was completely washed out. It was mid-April, 1907 before railroad service was resumed.[96]

Then the Meadow Valley track was relaid an average of four feet higher than before to prevent new flood damage. On New Year's Eve, 1909, the track in Meadow Valley washed out again. Service was not reinstated until June, 1910. Nor did the western end of the line escape damage at that time. Landslides and washouts occurred at Canyon Pass and Afton. In Meadow Valley Wash the roadway was rebuilt on safer, higher ground.[97]

By 1916 the operation was successful and the San Pedro, Los Angeles & Salt Lake abbreviated its name to Los Angeles & Salt Lake. In 1921 William A. Clark sold his half interest to the U.P.[98] The U.P. made the route even more financially successful when a spur line to Boulder Dam was built in 1930-1931. This spur carried heavy building materials and supplies.[99]

The Salt Lake route prospered during World War II and centralized traffic control was introduced in 1942 at Daggett. This control system was expanded the entire way to Salt Lake City by 1948.[100] The route's passenger traffic was ended in 1971 by Amtrack, but was restored in late October, 1979.

<u>Tonopah & Tidewater</u>

A Santa Fe feeder railroad running during its operation over the entire north-south length of the study area was the Tonopah & Tidewater. This railroad tapped the borax region of California. Borax was more prosaic stuff than gold, but often proved to be lucrative.[101] This area also probably contained the famed lost gold mine of Jacob Breyfogle, a befuddled prospector who could never again find his original strike.[102]

Among the first to mine borax in the region north of the study area was the one-time San Francisco vigilante, William Tell Coleman. He developed the Harmony Borax Works, mining the borax while 20-mule-teams carried the product to the station of Mohave on the Southern Pacific Railroad. In 1888 Coleman sustained financial reverses and his borax properties were taken over by Francis Marion "Borax" Smith, a veteran borax extractor. In 1872 Smith had discovered borax at Teel's Marsh near Candelaria, Nevada. When Coleman had financial difficulties, Smith acquired his holdings, the Lila C. Mine in Death Valley and the mines at Borate. Smith next combined all his properties to form the Pacific Coast Borax Company. In 1899 this company became an international corporation with headquarters in London and became known as Borax Consolidated, Limited.[103]

As the Teel's Marsh ores became exhausted, Smith concentrated upon his borate holdings. After 1900 the borate ores also became depleted. As a result, Smith exploited the most desolate part of the desert to operate the Lila C. Mine, 100 miles from the nearest railroad. The wagon road between the railroad and the mine was so rough that Smith decided to build his own railroad. The silver and gold discoveries at Tonopah in 1900 and Goldfield in 1902 helped to make up Smith's mind concerning the need for a railroad in this region. Eventually, after looking at other routes, Smith decided to select the old wagon road as the railroads basis. The important focal point of the railroad to Smith was the Lila C. Mine, and not the mining centers of Tonopah and Goldfield, despite the railroads name.[104]

In 1905 Smith selected Las Vegas, Nevada, as his railroad's terminal, since that place was a division point on Clark's San Pedro, Los Angeles & Salt Lake Railroad. Work began on May 29, 1905, and construction crews quickly moved out for nine miles. Then to his dismay, Smith found that Clark had changed his mind about cooperating with him.[105] Smith, therefore, decided to build north from Ludlow, abandoning Las Vegas as a base. The Santa Fe Railroad proved willing to cooperate with Smith. A construction workers tent city was built at Ludlow, and work on the grade northward began.[106]

On the new route Smith had to build 167 miles to reach Tonopah and Goldfield instead of the 118 miles that he originally planned. This longer distance delayed the building of the railroad. Eventually Smith decided that a branch line to the Lila C. Mine was enough and that his railroads main route should run through Goldfield. As a result, on November 19, 1905, work north from Ludlow commenced. The track was laid downward on the valley floor for the next 50 miles to Silver Lake. On the route north the T & T crossed over the Salt Lake Route at Crucero. There, as a symbol of their non-cooperation, the railroads each maintained separate stations, and did not run connecting trains.[107] From Crucero the T & T laid its track north of Rasor and then the booming community of Silver Lake by March, 1906. The summers heat slowed construction, and it was early 1907 before service began on the new railroad. By May, 1907, regular traffic reached Tecopa. It was ironical, that when the T & R reached Gold Center near Beatty, it found that William A. Clark's own feeder railroad, Las Vegas & Tonopah, had reached the same place a year earlier. The LV & T then had built on into Goldfield. Complicating the situation, another enterpreneur, John Brock, had built the Bullfrog Goldfield Railroad to Beatty, and then on to the boom towns of Bullfrog and Rhyolite.[108]

For the time being, therefore, Smith decided the T & T

would not build further north. Instead, with a trackage agreement with the Bullfrog Goldfield, it operated trains to Bullfrog and Rhyolite. This was the operating situation when, with the mining boom at Rhyolite and Bullfrog slackening, the B G Railroad became insolvent. Therefore, in June 1908, the B G and the T & T were controlled by a single holding company, the Tonopah and Tidewater Company.[109]

For the next six years, until 1914, the combined line was not prosperous. Branch lines were planned, although only one, the Tecopa Railroad completed in 1910, was ever built.[110]

Meanwhile, the T & T Railroad had its own operating difficulties. Flash floods plagued it. In the spring of 1910, the Mohave River crested at a flood stage, pouring water into Silver Lake's dry bed and flooding the tracks laid across it. Although trains at slow speed could creep through the water, they often sustained flooded firebreaks. To solve the problem the track had to be raised six inches above the lake bed.

T & T headquarters were maintained in a private car on a siding at Ludlow. From there the train's superintendent, Wash Cahill, ran the railroad's operations.[111]

The year 1914 saw many changes on the T & T. The Lila C. Mine became exhausted. It was replaced by the Biddy McCarty Mine, located 12 miles away from the Lila C. A branch line was constructed to it. In 1916 it was sold by the T & T to an independent narrow gauge railroad, the Death Valley, which then ran from Death Valley Junction to Ryan. The Death Valley Railroad's independence was largely a fiction, as its owners were substantially the same as the T & T. The year 1915 witnessed changes in the B G section of its line from Beatty to Goldfield related to the mining situation. Bullfrog and Rhyolite were no longer gold ore producing, and the Goldfield area had fallen greatly in production. As a result, the B G - T & T combined railroad revenues plummeted and the symbiotic relationship between mines and railroads was again demonstrated.[112] Now since the B G paralleled William Clark's LV & T from Beatty to Goldfield, the old rivals agreed that they would form one new route combining the best portion of each and abandoning unneeded track. The railroad that emerged was still called the Bullfrog Goldfield, but it was operated by the LV & T. The T & T lost its presence in Goldfield, but retained the short trackage from Gold Center to Beatty. To compensate for its loss of revenue, T & T opened a 1.3 mile branch line to the gypsum deposits at Acme.[113]

Floods still plagued the T & T. In January, 1916, heavy rains fell in southern California. Once more Silver Lake filled with water flooding seven miles of T & T track.

Other points also suffered washouts and it was months before service was resumed. Then a 7.5 mile line was constructed along the eastern edge of Silver Lake with salvaged materials from the abandoned Lila C. spur. In March, 1916, the Silver Lake station and warehouse collapsed. Consequently, the depot and the rest of the town were taken up and rebuilt on the lake's eastern shore adjacent to the new line.[114]

When the government through the United States Railroad Administration forced the LV & T into abandoning its service as superfluous, this deprived the B G of an operator. In September, 1918, the T & T put the B G again under its aegis with a five year operating agreement.[115]

About 1919 the Acme branch line was inactivated and in 1927 its tracks were removed to build the Carrara spur. Around 1920, for a brief period, a light narrow gauge railroad operated from the Lila C. Mine to Death Valley Junction. It lasted only a few years as the Lila C.'s production dropped again. Between 1921 and 1926 the Pacific Borax built and operated a 2 foot wide narrow gauge railroad to service their borax operations around Shoshone. This railroad tied into the T & T some four miles north of that town.

When the Death Valley Railroad suspended operations in 1931, the T & T widened the defunct company's track and operated over it. In the late 1920s a revival of marble quarrying at Carrara occurred. To carry these heavy marble blocks the T & T took rails from the Acme spur and built a Carrara sideline.[116]

Since passenger fares were high, few passengers officially rode the T & T. Passengers usually tipped the train crew and then were allowed to ride on the coal tender and the tops of passenger cars. Dining cars were not warranted by the traffic, so a restaurant was opened to care for the passengers dining needs at Shoshone.[117]

By the late twenties the Pacific Coast Borax Company again shifted its major operations from Death Valley to Borax near Kramer on the Santa Fe.[118] The first casualty of this shift was the B G Railroad which closed down in 1828. Three years later, as already indicated, the Death Valley Railroad also ceased to operate.[119]

The effects of the Great Depression ravaged the struggling T & T. As an economy measure in October, 1933, operations between Curcero and Ludlow ceased. This move forced the abandonment of nearly 26 miles of track. The tracks remained in place for years because of mortgage requirements, but service never resumed. The train "stops" at Ludlow were moved up to Death Valley Junction.

In the six years from 1933-1938 the T & T revenues averaged only 1/6th of their previous total during 1920. Losses approximated a quarter of a million dollars a year. The road continued running, since Borax Consolidated as guarantor of the railroad company's land, paid the interest and when necessary the operating deficit. This arrangement could not continue indefinitely and so, after heavy damage by flooding to the railroad in March, 1938, the T & T asked the Interstate Commerce Commission to allow it to cease operations. By 1939 it possessed, in addition to passenger equipment, only 29 freight cars and 4 locomotives. After ICC hearings the railroad was allowed to cease operation on June 14, 1940. After the United States entered World War II, the tracks in 1942-1943 were torn up from Beatty to Ludlow. Its ties and timber were used in nearby construction, and the railroad equipment was removed as other needs for its use arose. The complete legal abandonment of the railroad was authorized by the ICC in 1946.[120]

Settlements Within and Around the Study Area

It should always be borne in mind that the entire population within the about 19,000 square miles comprising San Bernardino County was merely 5,551 in 1860, 3,988 in 1870, and 7,786 in 1880. As late as 1900, the county's population had only expanded to 27,929 and 56,706 in 1910. The county's population only reached 73,401 in 1920, and finally amounted to 161,000 people only upon the eve of World War II.[121]

To illustrate how lightly populated the study area was, three geographical subdivisions, townships,comprised it and much adjacent territory as well in 1940. These townships of Amboy, Kelso and Ludlow contained 474,316 and 225 persons respectively; comparable statistics from earlier census years are not available,[122] although some inferences can be drawn. In 1880 the Mohave precinct of San Bernardino County, which literally comprised thousands of square miles, contained 150 people.[123] Beside the San Bernardino Township, which included the City of San Bernardino, the other townships into which the county was divided as late as 1900 still possessed the following populations: Hespera Township, 170; Vanderbilt Township, 329; Dale Township, 63, and Victor Township, 645.[124] This illustrates how lightly populated the Mojave Desert was generally, and the study area specifically, has been for most of its history.

The following are some of the more important settled places in and immediately about the study area, judged from the standpoint of historical impact.

## ACME

Originally called Morrison, probably after a railroader, it was renamed Acme after the Acme Canyon and/or mine. It served as a station on the Tonopah & Tidewater spur to the Acme Mine. In 1914, to compensate for the loss of the Goldfield business, the T & T built the Acme spur from Morrison (Acme) on the main track eastward past China Ranch, up Willow Creek's north side and then up a canyon to a gypsum mine at Acme--a distance of 1.3 miles. About 1919 two sons of the Acme Mine owner were killed in a cave-in and operations there ground to a halt. The spur, because of lack of business, was removed in 1927.[125] Between 1939-1943 there was a little mining of talc at Acme. The Acme Mine is located at Section 9, Township 19N, Range 8E, on the San Bernardino base line and meridian. Reopened briefly in 1948, the mine permanently went into production in 1951. In 1952 its output was 5,000 tons.[126]

## AFTON

Afton is a tiny hamlet located in Afton Canyon. It was built as a siding and named when the Salt Lake Route was constructed in 1904-05. It was probably named after a town in the eastern United States. Afton was the scene of a well-publicized accident in 1907 when two railroaders were killed by a crane while clearing tracks after a flood. In March, 1938, it was the area of a flood which seriously damaged the railroad. Afton today receives some business from I-15, which passes west of it, and from campers at a Bureau of Land Management campsite.[127]

## AVAWATZ

Avawatz (named for the Avawatz Mountains) was a short-lived post office during its early twentieth century mining boom. The Crackerjack mining boom nearby having collapsed, its post office was moved to Avawatz on August 13, 1908. The Avawatz boom proved to be ephemeral and the post office closed on December 15, 1910.[128]

## BAKER

Baker was a station on the T & T which was originally known as Berry, named after an old desert prospector. Because there were other places named Berry, the T & T in 1908 renamed the station in honor of its president, R. C. Baker. Although Baker had only 58 people as recently as the early 1930s, in February, 1933, a paved highway having been built through the hamlet, its own post office was opened by the postal department. This post office has been continuously in operation since that time. Today, situated just off I-15, Baker maintains several modern gas stations, motels, and restaurants which give important service to the freeway traffic between Los Angeles and Las Vegas.[129]

## CRACKERJACK

In the early twentieth century, Crackerjack was a boom tent city, complete with saloons and stores which was located to the west of the T & T Railroad near Avawatz Pass. An enterprising merchant of nearby Silver Lake, O. J. Fisk, ran a short-lived stage line to it from his home town. A railroad spur from the T & T was surveyed but never built to this town. A post office was established on February 26, 1907. On August 13, 1908 postal service was moved to Avawatz. The removal of the post office graphically signaled the end of the Crackerjack boom.[130]

## CRUCERO

Crucero was created in 1906 where the feuding T & T and S.P., LA and S.L. Railroads' rails crossed each other. The two railroads built separate stations and did not cooperate with connecting trains. Originally named Epson, in 1910 the name was changed to the Spanish for crossing--Crucero. Between April 18, 1911, and June 30, 1917, and again from November 11, 1922 to May 25, 1943, the hamlet had a post office. On the later date the postal facility was moved to Kelso. The closing of the T & T Railroad reduced the importance of the locale, but it remains a railroad siding of the Salt Lake Route.[131]

## LUDLOW

Ludlow has served as a station for the Southern Pacific Railroad since the 1870s. Ironically it was originally named for William B. Ludlow, who was the master car repairer for the Southern Pacific. Reorganizations of railroad ownership located this station on the Santa Fe line. Since the Santa Fe was willing to cooperate with a feeder line, the T & T, that latter railroad used Ludlow as its major construction camp, and later its operating headquarters. The T & T abandoned nearly 26 miles of track from Ludlow to Crucero in 1933. At that time the railroad repair shops were moved from Ludlow to Death Valley Junction. The post office at Stagg (Stedman) was moved on September 15, 1926, and relocated at Ludlow. Ludlow today has some importance as a service facility for traffic on I-40.[132]

## RASOR

Rasor for many years was the first station north of Crucero on the T & T Railroad. It was named for the Rasor brothers who were railroad surveyors. Clarence Rasor had been particularly active in surveying the T & T route. In the 1930s Rasor served as a source of water for Baker when that town grew. Today Rasor is simply a service stop on I-15.[133]

# SILVER LAKE

Silver Lake was one of the few T & T stations in the planning unit to have a pre-railroad existence. The town was situated on the edge of a large, dry lake which provided its name. In 1906 it was already a sizable desert trading community, as it was located on the Old Arrowhead Trail and close to the then flourishing Crackerjack mining camp. It possessed a general store called the Rose, Heath, Fisk Company, which reported an annual business of almost $150,000. Also, O. J. Fisk, one of the partners in the store, ran a stage line for a short time between Crackerjack and Silver Lake.

In the spring of 1910, as a result of heavy rains, water rushed into Silver Lake and did not evaporate. The railroad problem was solved by raising the tracks six inches. The town was not permanently, adversely affected by this disastor. Then, in January, 1916, heavy rains again poured down throughout southern California, and Silver Lake was flooded again. At that time 7 miles of T & T tracks were under water. For a time the Silver Lake depot and warehouse, which had been constructed on stilts, was the only dry building in town, as the depot had been elevated to a level corresponding to a freight car's height. However, in March, two months after the flood, the freight depot and warehouse suddenly collapsed.

As the water evaporated slowly, the T & T was forced to make a lengthy detour. In the end the railroad built a 7½ mile line along the lake's eastern shore. When the line was relocated, a gasoline tractor dragged the wooden station/ warehouse to a higher elevation along the newly revised right-of-way. The remainder of the town also relocated on the new site.

Silver Lake had had an early start since it was located near Cox's Cut-Off, a heavily used trail during the 1860s. Silas C. Cox, a San Bernardino-to-Salt Lake freighter, pioneered this route. The road later obtained prominence because it was on the Old Arrowhead Trail which ran between San Bernardino and Utah. This trail was used by wagons in the nineteenth century, and later it was utilized by motor cars. In the 1920s, before the paved road through Baker 8 miles to the south, it was considered the best motor link between southern California and Salt Lake City. That it was far from ideal is inferred from the fact that, in 1924, Mrs. Gus Johnson who operated a general store in Silver Lake in the 1920s and 1930s could, at best, drive her car from the California coast to Silver Lake in 17 hours. The Old Arrowhead Trail bears east from Garlic Springs, past Iron Mountain Mine and lays between Soda Lake and the Avawatz Mountains. Then, it ran across the northern shore of normally dry Silver Lake to the town itself. It then crossed the T & T grade and turned east through Riggs Wash and into the Hollow Hills.

After the highway (91 and 466, earlier than the present I-15) was built, it looked as if Silver Lake's only future would be a way station on the soon to be abandoned T & T. Hundreds of workmen were brought into the area during the 1930s to build the Boulder (Hoover) Dam power transmission lines to the Southern California region. The town boomed. It was deserted when, after completing their work, the Boulder Dam transmission line workers left and the T & T was abandoned. Silver Lake's post office, which had operated since March 27, 1907, was moved to Baker in February, 1933. It had a brief moment of publicity in March, 1938, when its namesake lake was again flooded, and even fish were reported in that once "dry" lake.[134]

## STEDMAN/ROCHESTER AREA

This area is located eight miles south of Ludlow. It was also at times known as Stagg, Stedman and Rochester. It began when a railroader, John Suter, in the late nineteenth century staked a claim to this area which he called, probably derived from the state of Ohio, the Buckeye Mining District. By 1900 John Suter had formed his own company and worked the Bagdad Mine. In 1909 Suter sold out to an organization of New York financers who formed a new company, the Bagdad Milling Company, with E. H. Stagg as general manager. The post office at the main mine was named for him. This post office operated from February 15, 1902, until the mine's decline, when it was removed to Ludlow. The settlement at the foot of the mine sustained a post office called Stedman from March 28, 1904 to November 30, 1905. Many of the mining employees who came from New York preferred to call the settlement, particularly after the post office closed, Camp Rochester.

The climate was harsh--hot in summer and cold in winter. It had a short rainy season, but the area was usually parched and dry. The workmen's houses were "light clapboard"--rather widely dispersed so as to minimize the danger of fire. Both liquor and a red-light district were sternly barred. Water was virtually unobtainable at the site and was carried to it by the railroad. In 1916 after a change of ownership, the railroad no longer operated as a common carrier. Nonetheless, the railroad was used occasionally, as the mines were leased out until 1932. About then, because of an accidental fire burning its equipment, coupled with a track washout, the railroad was unuseable, and its tracks were permanently removed in 1935.

The mines operated sporadically until 1954, although the parent company experienced many name changes. As a ghost town Stedman is the more popular name denominating this locale, probably because there was already another Rochester in the county.[135]

## Ranching

The first cattle in the study area were probably transported through the Mohave trails by the Indians after being stolen from the Spaniards in coastal California. The Utes and renegade mountain men seem to have utilized the Las Vegas arm of the Old Spanish Trail for horse and mule stealing from the Mexicans in Alta, California. More legitimate traders probably crossed the Mohave on the way to the Colorado River by way of trails along the Thirty-fifth Parallel Trail, or the Government Road as it would later be known. Along the traders way, their livestock were occasionally captured by the desert Paiutes. These captured animals were not used as starter stock by the Indians, but were instead the main dish in an immediate feast.

American exploring parties brought some, but an unknown number of, livestock with them into the study area. After 1859 herds of livestock were shepherded through the study area on their way to provision Fort Mohave. These animals grazed wherever the grass was sufficient. Miners entering the Mohave area after 1863 had with them mules, horses and, undoubtedly, cattle for meat and milk. As mining camps were established there were cows and sheep raised near them to supply the improvident, happy-go-lucky miners with fresh meat.

Later the temporary army garrisons in and around the study region during 1866-1868 had small stock herds with them. Also, Fort Mohave continued to be a magnet, drawing many horses and cattle from coastal California through the study area to the Colorado River.[136]

Ranching in the Mohave between 1860-1900 occurred on a small scale and where it was environmentally possible, although by the end of the period, it had been replaced by a more diversified agriculture. Extensive ranches existed in places such as the Chemehuevi Valley, west and north of modern Cima, and in the high country of and near Lanfair Valley. The railroad, and eventually deep well drilling equipment, made possible new ranch development in the 1900s.[137]

Although printed documentary livestock statistics in the study area alone are impossible to get for the early years, they do exist for San Bernardino County as a whole. The overwhelming number of persons lived in the southwest corner of the county. So the amount of ranching in the study area, while considerable for a thinly populated area, still must be viewed in proportion to its absolute importance.

In 1880, in all of San Bernardino County, there were 57 working oxen, 2,101 milk cows and 5,361 other cattle. All the sheep in the county numbered 48,538.[138] Twenty years later, in 1900, San Bernardino County reported 12,481 "meat cattle" and 11,086 sheep.[139] By 1925 San Bernardino County

reported 1,880 sheep and 37,167 cattle in this political sub-division.[140] Twenty years later in 1945, at the end of World War II, in more complete returns, San Bernardino County was listed as having 2,723 farms with 272,300 cattle, as contrasted with 2,710 farms reporting 237,280 cattle on the eve of World War II in 1940. In 1940 San Bernardino County reported 59 farms raising 6,346 sheep, whereas in 1945 it had 46 farms claiming ownership of 14,170 animals.[141] By 1969 San Bernardino County stockmen raised 133,004 cattle on 640 farms and 19,797 sheep on 70 farms.[142]

An example of a large livestock operation is the Rock Spring Land and Cattle Company. Although this company operated mainly to the east of the study area, it did at times run cattle there. This company was incorporated in 1894 to raise cattle on a corporate basis, and upon a large scale. Its headquarters were originally in Pioche, Nevada, but were later moved to Los Angeles. The company operated in the southern Nevada and eastern Mohave area of California. In that era of few competitors and minimal regulations, the company occasionally grazed into the study area. For 33 years the Rock Springs Land and Cattle Company remained an important force in Mohave area cattle industry. Then, in 1927, the company was subdivided when one of the original stockowners died.[143]

At the last federal agricultural census in 1974, although the southwest corner of San Bernardino County predominated in the ranching of that subdivision, the study area showed upwards of 40,000 acres in farmland and approximately $1,000,000 derived from selling livestock, poultry, and their products.[144]

Farming

Homesteading in the Mojave Desert started seriously only as late as 1912. The earlier real estate boom in coastal southern California had not reached as far as the desert. Yet after several years of a wet cycle, homesteads, about 1912, began to appear in the Mojave. Alluvial slopes near playas and highland valleys were the sites of homesteading attempts. The land was developed in a spotty fashion, as homesteaders took possession of only the most likely areas. Homesteaders in the Mojave favored the Cronese Valley to the west and Lanfair Valley to the east. Problems, such as lack of rainfall, floods, and inaccessibility, caused the tide of dry farmers to recede by 1925, leaving little to show for all the effort.[145]

After the Great Depression of 1929 began in deadly earnest in California, there was a tide of unemployed persons from the cities who took over abandoned homesteads and worked old mining claims. It was only a bare living. Therefore, as times improved in the 1930s, these desperate attempts were abandoned and almost all the unemployed in the Mohave Desert sought jobs in the California cities.[146]

Military

The Desert Training Center, or as it became after its area included lands across the Colorado River--the California-Arizona Maneuver Area--was created during World War II. Its headquarters were located at Camp Young near Indio. The military maneuvers generally took place outside the immediate study area. Yet, these maneuvers had an important effect on the region, as many men who had never seen the California desert learned to live and work in it.[147]

Since World War II military installations have been part of the desert scene. The relative nearness of the Pacific Theater during World War II initiated the placement of military installments in the Mojave. Many were discontinued after that conflict because of worsening world conditions during the Cold War. Every one of the major services maintains, or has maintained, a large installation in the Mojave. On the edges of the study area were the army's Camp Irwin, and Twenty-Nine Palms Fleet Marine Force, Pacific Weapons Training area. Camp Irwin since 1970 has been deactivated by the army, but it is still utilized by the California National Guard.[148]

Military installations need communications, space and favorable climatic conditions. Another important factor in military installation location is fast transportation. The Mohave is served by two trans-continental railroads, the Santa Fe and Union Pacific, with a third the Southern Pacific not far away. Eight U.S. highways cut through San Bernardino County. As early as the 1940s the desert area possessed some towns where supplies could be obtained and the necessary civilian labor forces based. Interestingly, only one community, China Lake-Ridgecrest, represents an inhabited area started since 1940, although many older communities such as Victorville and Mohave have gained population because of military installations. Between the Korean War and the early 1960s it was estimated that 28,000 military employees and 10,000 personnel from civilian constructions were employed in the Mohave.

Military installations need extensive space, since open tracts are required to test missiles and aircraft, and for use as gunnery ranges. By the 1960s, 1/6th of the Mojave Desert lay within military bases. Military bases are located in the main in a favorable climate. In this dry desert area, supplies and machines can be safely stored out of doors. This type of climate, where preservation of machines is favorable, allows an excellent environment for storage and repair depots.[149]

Two cultural-environmental factors have developed in the twentieth century influencing desert use. These factors

operated successfully before World War II, but have become particularly important since that time. The first factor was the growth of Los Angeles as a financial center, and also as a source of investment capital for all southern California, including the Mojave.

The other factor was, and remains, the technological advances made by the United States in the twentieth century. After 1930 better paved roads and sturdier automobiles had been developed. These factors brought many changes, transforming the desert--service stations, roadside cafes and motels. Deep wells can create oases in the desert where none naturally existed. Air conditioning has made the hot desert bearable. Men can live and work in the desert more easily than ever before.[150]

Since World War II the megalopolis of Los Angeles has sent many thousands of people into the desert to seek various types of recreation, from bird-watching to the use of off-road vehicles. This has demanded additional recreational facilities on public land, as well as increased regulation of its use by the Bureau of Land Management and other federal agencies.[151]

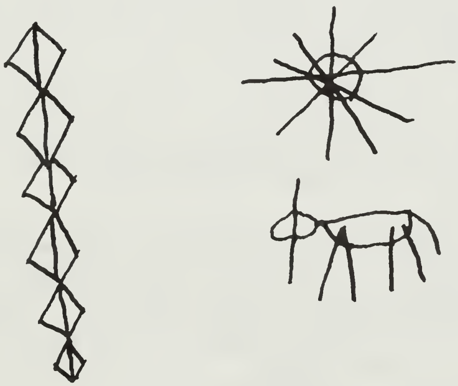


Illustration of petroglyphs from Cady Springs as recorded by Malcolm Rogers. Rogers recorded this site as M-42 and indicated that these were "scratched Chemeheuvi petroglyphs." Records on file at the San Diego Museum of Man. Illustration by Russell L. Kaldenberg.

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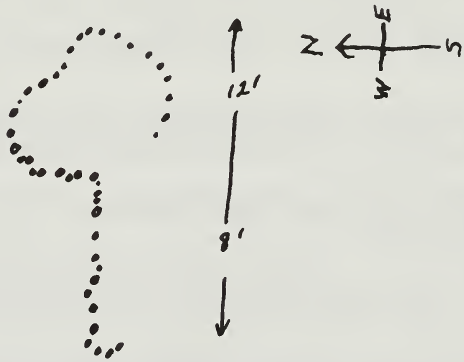



Illustration of "Malpais (?) ceremonial of the boulder-alignment type." From notes of Malcolm Rogers. Site is recorded as M-156B, Quail Lake in the Owlshead Planning Unit. On file at the San Diego Museum of Man. Illustration copied from Rogers'notes

# SECTION 2

# ETHNOGRAPHIC BACKGROUND

## The People

The southern half of the Owlshead/Amargosa and Mojave Basin planning unit lies within the ethnographic territory of the Chemehuevi. As a southern Paiute group, the Chemehuevi spoke a Numic language and practiced a subsistence economy based on hunting and gathering. The environment in which they lived precluded a large population density and enforced the somewhat nomadic lifeway of the family level of socio-cultural integration familiar throughout the Great Basin.

## Distribution, Identity and Linguistic Affiliation

Post-historic distribution of the Chemehuevi included a major portion of the Mojave Desert. Their territory extended from the Kingston Range south through the Providence Mountains to the approximate boundary of present day Riverside and Imperial counties; westward to Newberry Springs and eastward to the Piute Mountains (Van Valkenburgh 1974). As the southern-most extension of the Numic linguistic family, the Chemehuevi occupied the lands between the Yuman and the Takic linguistic groups. The Kawaiisu, who spoke another Numic language, were located to the northwest in the area of Searles Lake. The Vanyume Serrano were centered around Daggett and along the Mojave River. The Serrano proper occupied the area of the San Bernardino Mountains with the Cahuilla to the south. The Mohave were located to the east, principally along the Colorado River.

Evidently the Chemehuevi were friendly with the groups to the north and west, although there is conflicting evidence that the Chemehuevi and Serrano may have had occasional quarrels (Bean and Smith 1978:570 and 572). The Vanyume along the Mojave River were sparse and poor, being rapidly decimated around the 1820s and extinct by 1900. They had enjoyed good relations with both the Chemehuevi and Mohave (Bean and Smith 1978:570).

Some time after 1776, the Halchidhoma and the Kohuana were driven from the lands west of the Colorado River by the Mohave and Yuma. The Chemehuevi moved into this area and maintained a fairly close relationship with the Mohave until unrest in 1867. The Chemehuevis in this area then fled across the desert and settled near Twenty-Nine Palms with the Serrano and later at Cabezon with the Cahuilla (Manners 1974:26).

> The Mohaves were the Chemehuevis' closest neighbors...The relationship between the two tribes was close, almost symbiotic. Each was to the other the essential enemy. To the Chemehuevis...enemy was virtually synonymous with Mohave...Mohaves ambushed Chemehuevis and vice-versa. Also they derived great satisfaction from their mutual contempt. Chemehuevis were revolted by the place that fish held in the Mohave diet, and Mohaves were equally disgusted by "lizard eaters." None of this prevented their visiting back and forth, intermarrying, and learning each other's language and songs...They traded artifacts, and no doubt to a certain extent each tribe assimilated the skills of the other... Their enmity was almost (until recent years) without hatred, at least without deep, bitter and enduring hatred; it was as though they united in playing out a stylistic (though deadly) game of war (Laird 1976:141).

Other records indicate that the Chemehuevi in the area of the Providence, Paiute and New York Mountains were enemies of the Desert Mohave (Laird 1976; Van Valkenburgh 1974). At any rate, Van Valkenburgh states that "the post-historic shifts of the Chemehuevi seem to have emanated in the disturbances of their quarrelsome Yuman neighbors on the Colorado River" (1974:228).

A Chemehuevi informant delineated a trail which spanned Chemehuevi territory from the area of Victorville to Fort Mohave. It was described as follows:

> Victorville to Stoddard Wells--to fish ponds just below Daggett--6 or 8 or 10 miles--Camp Cady. Next place at caves--next to Soda Lakes--sinks of the Mohave River--Soda Lake to 17 Mule Point (between Soda Lake and Marl Springs)--to Government Holes. Pass through mountains to Rock Springs. To Paiute Spring to Bauer Lake to Hardyville to Fort Mohave (Van Valkenburgh 1974:252).

There were essentially three sub-divisions of the Chemehuevi proper: The Northerners occupied the land along the northern reaches of the Colorado River with the Southerners along the river to the south; those who occupied the land back from the river to the west were called Desert Chemehuevi. "Nonetheless, constant visits back and forth, shared war parties and hunting expeditions, as well as intermarriage...must have made for considerable tribal homogeneity (Laird 1976:8-9). The aboriginal population of the Chemehuevi proper was probably somewhere around 500 to 800 people based on a

reduction of one- to two-thirds of the population at the last Federal census of 350 people (Manners 1974:27).

Chemehuevi is a dialect of the Yutish sub-family which stems from the Numic linguistic family of the Shoshonean languages of the great Utaztekan stock (Goss, 1968:18 and 25). Its derivation is diagrammed below.

```
                    UTAZTEKAN
                        \
                      SHOSHONEAN
                           \
                          NUMIC
                             \
                            YUTISH
               ________________|_________________________
              |                                          |
             UTE                                      KAWAIISU
    __________|______________________
   |                                 |
CHEMEHUEVI   KAIBAB   N. PAITUE   S. PAITUE
```

It has been hypothesized that Ute began to break from Kawaiisu some 800 to 900 years ago somewhere in the vicinity of southern California. Ute in turn became linguistically divergent as the various groups spread into the Great Basin. Thus, it would appear that the spread of the Yutish speakers across the Great Basin is a fairly recent event.

> Remember, the marked distinctions between the Southern Paiutes are cultural, not linguistic. The "Utes" are just the Yutish groups that happened to reach the Great Plains...The cultural boundary, which is so sharply drawn by some ethnographers, between the "Southern Paiutes" and the "Utes" indicates only the western boundary of marked Plains influences at the onset of the reservation period (Goss 1968:35).

> The shallow dates between Chemehuevi on the western extreme and the Utes on the east, seem to indicate a very recent expansion into the Basin. Perhaps the easternmost Utes only reached the Plains about 2 or 3 centuries ago, represented by the Northern Ute-Southern Ute divergence (Goss 1968:27).

Further evidence from Yutish place-names would seem to support this recent expansion. Sapir suggests that:

> The analysis of placenames is frequently a valuable means of ascertaining whether a people have been long settled in a particular region or not. The longer a country has been occupied, the more do the names of its topographical features and villages

> tend to become purely conventional and to lose what descriptive meaning they originally possessed (1916:56).

In pointing out Sapir's analysis, Goss goes on to state that:

> Almost all Yutish place names are descriptive and easily translated. The purely conventional place name is the rarity here. Hence, the inference: Evidence from the place names indicates recent expansion of Yutish speakers in the historic doman (1968:31).

Goss is further corroborated by Laird (1976:119) as she points out that Chemehuevi place-names are vividly and concisely descriptive; even though she further points out the advantages of descriptiveness in finding one's way across vast expanses of desert.

## Social Organization, Subsistence Economy and Material Culture

The Chemehuevi inhabited a broad expanse of desert domain. Aboriginal exploitation of arid lands demanded mobility and prohibited the aggregation of large numbers of people in any given area. Thus the Chemehuevi followed a lifeway familar throughout the Great Basin: small, basically self-sufficient extended family groups, hunting and gathering for themselves and coming together in communal interests periodically through the year (Kelly 1934; Steward 1938).

The basic social organization of the Southern Paiute, to whom the Chemehuevi are related, was predominated by what Steward (1938:75) called 'family particularism'. The extended family was the encompassing social unit throughout most of the year although groups of families would travel, gather and hunt together where seed crops and game were abundant. The communal hunting of deer and mountain sheep was an example of cooperative alliances between families, and winter residence was usually in small villages of such allied groups. Allegiance to the village, though, was secondary, and an individual's behavior and social ties were governed to a greater extent by kinship and the family group (Steward 1938:75).

At one time, the Chemehuevi may have been divided into moieties, with one group inheriting the Mountain Sheep Song and the other, the Deer Song. Ancestry was not traced to either the mountain sheep or the deer, and no real totemism accrued. Only certain parts of either animal were taboo to the man who had killed it and there was no strict regulation about hunting the animal of

one's inherited song. Other inherited songs of lesser importance were the Salt Song, the Day Owl Song and the Quail Song, all of which were probably closely related to the Deer Song. The Mountain Sheep Song covered by far the greatest extent of land. It was centered along the Colorado River and around the area of the Providence, Ivanpah, New York, and Piute Mountains, but extended across the Mojave Desert from the Granite Mountains to the San Bernardino Mountains (Laird 1976).

The people of different mountain ranges and territories had different versions of the two dominant songs. The inheritors of the song were said to 'own' the particular hunting lands which were associated with the different versions of the two songs. It does appear, though, "... that everyone was either a Mountain Sheep or Deer..." and when they hunted they would "invite outsiders to go along with them--these outsiders being perhaps visitors from other tribes or men who had married into the tribe" (Laird 1976:9).

Marriage was exogamous at least between the groups with different versions of the two dominant songs, although there is no real evidence of exogamy between the main divisions of the Mountain Sheep and Deer (Laird 1976:21). Residence after marriage was usually matrilocal. Steward (1938:57) points out a strong preference for matrilocal residence in the southern part of the Owens Valley as well and states this may have been connected with female ownership of valley seed plots. Essentially, though, individual family groups could reside wherever they wished. In general, residency was governed by availability of seed crops. Where such foods were abundant several families would occupy the same locality which resulted in the formation of small 'bands' of extended families. Each of these 'bands' had a spokesman but allegiance to him was based on residence in, and not on inheritance of, a family's hunting territory (Laird 1976:22).

The spokesman of any large band was a 'high chief' and could preside over assemblies gathered for consultations concerning various matters. When a 'high chief' was deemed unsatisfactory, he could be replaced with "one who would act in accordance with tradition and with the will of the people" (Laird 1976:29).

Groups would come together frequently through the year at the Gathering, a time of consultation and communal activity. The annual ceremony of the Cry also contributed to group cohesion. It was a time for mourning those who had died the previous year. Usually, belongings of the

dead and certain gifts were burned, after which the names of the dead were never spoken again (Laird 1976; Steward 1938).

The Chemehuevi had a strong sense of the supernatural. Shamanism was most generally related to healing but could also involve the willing of disaster and illness as well as the protection of game animals from 'outsiders'. Shamanistic power was achieved through dreams and meditation and involved the help of animal familiars. Both shamanistic and hereditary songs could be acquired from the sacred cave and the cave itself was thought of as an entity. Whirlwinds were thought to be supernatural demons which were disliked but not feared. A decoction made from Datura was taken to gain the power to reveal enemies or to find mislaid objects (Laird 1976).

The spirits of the dead were thought to travel to the far north, to a land of abundance and beauty. In life, an individual's hunting range and relationships were defined by hereditary songs; after death, by the particular color of corn which was his (Laird 1976).

> The rites of death were and are sacred and of immense importance. The funeral was of necessity held without much preparation, but was followed, perhaps as long as six months or a year later, by...the Cry or Mourning Ceremony...(For it must be remembered that the Chemehuevis were great travellers. Families sometimes travelled alone or in small groups, and deaths must often have occurred during these periods of isolation.) At the time of the funeral, women relatives of the deceased cut their hair...some property was burned, and there was ritual singing. Not much more could be done, considering the short time which must elapse between death and burial (Laird 1976:41-42).

For the Cry or Mourning Ceremony,

> Extensive and elaborate preparations were made. A date was selected, three months, six months, or even a year after the funeral. If there had been several deaths fairly close together, the bereaved families might choose to cooperate in providing for a single Mourning Ceremony. September was often the month chosen because food would be plentiful at that time...Eagle feathers braided into bands and also the whole skins of eagles cured with the feathers on them were used ceremonially at the Cry...The Chemehuevis did not catch and keep eagles

> when no Mourning Ceremony was in prospect, but they sometimes bought them from other tribes, usually the Walapais (or Serrano) who did make a practice of keeping them. No special ritual was connected with the killing of eagles (Laird 1976:42).

> When the date of the Cry had been set, the knotted string was sent out...At the Cry the ritual songs were sung...Valuable goods, which had been purchased by those giving the ceremony were given away...All possessions of the deceased which had not been burnt at the time of the funeral were now burnt, along with other articles belonging to close friends (Laird 1976:42-43).

The Scalp Dance and the Ghost Dance were both known as the Circle Dance. Both probably served as an emotional catharsis, with the Scalp Dance being older and the Ghost Dance a newer innovation. The Ghost Dance probably helped to alleviate the 'sense of doom' which much have come with historic contact and a time of cultural and social upheaval. In some instances, the Ghost Dance songs began to substitute for the hereditary songs of pre-contact times (Laird 1976:44-45).

> Being primarily nomadic hunters and gatherers, and only incidentally planters, the Chemehuevis never evolved an organized priesthood...elaborate rituals, or great symbolic seasonal dances. Their principal cultural carriers were songs and myths, primarly the latter, although songs were also tremendously important in this respect...Chemehuevi myths transmitted racial and tribal behavior, and, through symbols, a highly developed psychology (Laird 1976:209).

Chemehuevi origin myth relates to "Ocean Woman" and tells of the beginning of all tribes as coming from a basket carried by "Coyote" from an island in the sea. This myth, and all others, were passed down in the oral tradition, being told with individual embellishment and lengthened or shortened to fit the occasion. Winter was the proper time for storytelling, 'when the snakes were asleep' (Intertribal Council, 1976; Laird 1976).

The Chemehuevi followed a subsistence economy based on hunting and gathering and the seasonal round. In the early spring when winter stores were depleted, the young beans of the mesquite were gathered and eaten whole while still young and succulent. The young shoots of various plants were collected and eaten as grass. Fruits from the devil's pin cushion and prickly pear cacti were also exploited. Yucca dates and buds from the joshua tree

were collected and eaten raw or roasted and could be stored for short periods of time. Where available, agave was collected and roasted in pits. As early summer approached, seeds ripening in the lower valleys could be gathered and eaten at the time or stored in baskets with potsherd lids for future use. The more dessicated mesquite beans of the summer months were gathered and leached in pits for immediate consumption or cached in elevated granaries. Both the honey bean and screw bean mesquite were exploited but the honey bean was preferred. In the late summer, the people would move to the mountain slopes to gather the later maturing seeds of the higher elevations (Beals and Hester 1974; Drucker 1939; Laird 1976; Steward 1938).

> Because seeds are small, they must be gathered in large numbers to be profitable. Where vegetation is as widely dispersed as in the desert valleys and mountains, this called for considerable mobility on the part of the Indians. The radius of action of a single camp site soon was depleted because women gathering seeds had to cover a comparatively large area each day. Therefore, the family had to move frequently and in the majority of cases was unable to select spots near water or other places of convenience. The major requirement in selecting a campsite while seed gathering was a plentiful seed crop (Beals and Hester 1974:215-216).

Pinyon pine nuts ripened in the fall and were gathered with the aid of a fire bent hook on the end of a fifteen to twenty foot pole. The cones were burned to extract the nuts which were stored in grass-lined pits in the vicinity of the winter camp (Steward 1938). Storage of the nuts influenced the location of winter residency. Location of the winter village and the groups comprising it could thus change from year to year depending on where people eventually went to gather (Beals and Hester 1974: 212).

Among the Southern Paiute, the annual fall festival was held just prior to the pine nut harvest. It was generally a time of communal activity and of pursuing the social amenities of courtship and marriage. Lasting three to four days, the festival was terminated with the Mourning Ceremony (Steward 1938:184).

Among the Chemehuevi, horticulture was an introduced technique, probably borrowed from the river Yuman tribes. The principal cultivated crops were wheat, beans, corn, squash and melons. In the vicinity of the Colorado River natural flooding of the river supplied good fields and water. Around springs in the desert, water was carried

to small plots or diverted from its natural flow in ditches, but irrigation was also a borrowed technique. Near the river, plots of wheat were planted in the fall and left through the winter. When the people returned in the spring, young crops would augment the early spring diet (Laird 1976; Steward 1938).

Game was relatively scarce in Chemehuevi territory and successful hunting of the large animals like deer and mountain sheep probably only came with the advent of the bow and arrow (Laird 1976:5; Steward 1938). The main animal foods exploited were rabbits, hares, deer, mountain sheep, wood rats, mice, quail, chuckwalla and the desert tortoise (Beals and Hester 1974; Laird 1976). Meat was roasted or pulverized with the bone and formed into small cakes. For storage, the fat was removed and strips were dried. The blood was cooked in a paunch or gut (Drucker 1939:10; Intertribal Council, 1976). The procurement of these foods was generally on an individual basis although communal hunting of deer and mountain sheep did occur (Laird 1976; Steward 1938). Rabbits and hares were taken by trap or fire surrounded, and rodents could be pulled from dens with a stick twisted into the fur (Steward 1938). Evidently, the Chemehuevi found fish distasteful and there may have been an ancient taboo against eating them (Laird 1976:46). This is in part corroborated by the total lack of reference to any material culture items associated with the taking of fish (Drucker 1939:7-8).

Men fashioned caps of animal skin ornamented with quail feathers for themselves; women made basketry caps. Summer dress was usually sparse, the women wearing only small aprons and the men, short breechcloths. In colder weather, coverings of buckskin and rabbit-skin blankets, fashioned from furred strips and lashed together, afforded protection. Basketry was both coiled and twined, and basketry winnowing and parching trays were prevalent. Pottery was made with the paddle-and-anvil technique and crushed rock and sherds were used for temper (Drucker 1939).

In the preparation of foods, stone mortars, both bedrock and portable, were employed. Stone pestles were used with both hands and were not elaborately shaped. Wooden mortars were also used, particularly in the preparation of mesquite beans. Metates were rectangular and unifacial and a back-and-forth motion was used in the grinding of foods. The Chemehuevi also used a food stirrer made of three sticks lashed together and ladles fashioned from tortoise shell and gourds (Drucker 1939:13-14).

The Chemehuevi made both a recurved five-foot self-bow and a three-foot sinew backed bow. Arrows made from cane had a hardwood foreshaft and were both tipped and untipped. For small game, untipped arrows of arrowweed or hardwood were generally used. Pressure retouch on stemmed points and other tools was done with bone or stone flakers and the use of a hand protector. Butchering was generally done with an unhafted tool, although hafted knives were sometimes used. Bone scrapers and rubbing stones were used to dress skins, and brains from the animals were rubbed into them to increase pliability. Awls were most generally made from bone (Drucker 1939:14-16).

Glue for patching and for cementing such things as sinew to bows was obtained from several different sources. It was made by boiling horns from the mountain sheep or collected as pitch from the pinyon pine. Gum, deposited by a small insect on the creosote bush, was also collected and mixed with pulverized rock and heated just prior to use (Beals and Hester 1974:234).

A sexual division of labor accrued from the fact that both sexes usually made the items which they used. Women made the baskets, pots and other implements employed in the procurement and preparation of vegetable foods. Men fashioned the tools necessary in the hunting of small and large game, although women and children also assisted with the smaller rodents and reptiles. Men usually made the cordage, leather goods and rabbit skin blankets (Drucker 1939; Laird 1976; Steward 1939).

The Chemehuevi would seek out small caves and rockshelters for protection from inclement weather. They would also make brush lean-tos or ramadas for protection from the sun in summer.

More elaborate dwellings were constructed, particularly in the area closer to the Colorado River, for winter residence. These structures were semi-subterranean and constructed of four medial posts. Numerous peripheral posts held up an overlayer of brush and grasses, with a vertical double, sand-filled front wall (Drucker 1939; Laird 1976; Steward 1938).

Personal adornment was achieved in various ways. Both males and females pierced their ears, and some males would pierce the septum. Tattooing was common, particularly on the forehead, and females would tattoo vertical lines down the chin. Non-ritual painting of the body was also common. Hair was worn long, past the shoulders, and males usually tied it into numerous 'pencils' down the back. Necklaces were made from shell beads and pendants traded in from the coast (Drucker 1939).

## Post-Contact Disintegration

The Chemehuevi were never missionized as were their neighbors from the San Bernardino Mountains and west. The terrain would not support large populations, and their habitual tendency to wander about made it difficult to keep track of them (Cook 1976:193). Nonetheless, the upheaval in southern California, which reached its peak in the mid-1800s, most surely had an affect on them. The general reduction of the Indian population in southern California from warfare, disease and forced removal in the 1800s decimated the aboriginal population. This, coupled with the 'attack from the rear by white settlers' and the depletion of aboriginal hunting and gathering territories, reduced the Indian inhabitants and forced them into a less favorable environment (Cook 1976:232; Intertribal Council 1976; Steward 1938).

Petroglyphs from Malcolm Rogers' site M-19 at Francis Spring. Rogers indicates that the petroglyphs are located on lava blocks. Illustration copied from Malcolm Rogers' notes on file at the San Diego Museum of Man by Russell L. Kaldenberg.

# SECTION 3

# GEOGRAPHICAL AND GEOLOGICAL BACKGROUND

## Geography

The Mojave Desert is a natural region that occupies a large part of southeastern California. This natural region is defined by geographic boundaries identified by Thompson (1929). The northwest boundary is the Tehachapi Mountains, or roughly the Garlock fault. The southwestern boundary includes a group of ranges, the Sierra Pelona, the San Gabriel Mountains, and the San Bernardino Mountains, and roughly coincides with the San Andreas Fault of west Cajon Pass. Thompson describes the northern boundary at the 35th parallel from the Sierra Nevada Mountains to the Colorado River. The eastern boundary is generally considered to be the Colorado River.

The topography of the Mojave Desert is typified by low mountain ranges that separate many undrained alluviated basins. These ranges have no definite pattern, but in the eastern and central portion many of them trend north or northeast. Relief increases eastward as altitudes of the alluviated valleys increase from 4,000 ft at the western margin to near sea level at the Colorado River (Dibblee & Hewett 1970).

## Climate

Landform, vegetation and climate comprise the major elements of the natural landscape. Of the three factors, climate is considered to be the dominant factor in the modification of a natural realm. While climate is not completely independent, it does have a significant effect on the other factors in the development of a natural landscape.

In general, the climatological data for the East Mojave Planning Unit also characterizes the Amargosa/Mojave Basin Planning Unit. The area

> is characterized by minimal annual precipitation, low humidity, broad ranges in daily temperatures, relatively high year-round temperatures, and occasionally strong seasonal winds...Since precipitation and humidity are slight, and temperatures generally high, the climate is usually classified as arid or dry...However, low moisture levels and high temperatures do not necessarily define a climate as arid unless these tendencies can be compared with the water need of an area...In this case, the water need may be defined as the amount of moisture needed to meet evaporation and transpiration requirements.

> As the planning unit consists of a region where little or no water surplus exists in any one season, the climate can be labeled "arid", since the region's water deficiency is far larger than potential evapotranspiration....
>
> Precipitation...develops from two main sources ...During the winter, the rain falls primarily as a result of easterly migrating cyclonic storms that originate over the Pacific Ocean...Locally heavy convectional precipitation may occur during the summer as unstable masses of moist tropical air developed over the Gulf of California, Gulf of Mexico, and lower Colorado River, enter the region from the south. High intensity, short-duration summer downpours (or thunderstorms) occur in the ...region on the order of ten to twenty times a year, falling most often in July, which may have as many as six such storms of up to two hours duration each (King et al. 1976:72-73).

The Mojave Desert in general is classified as an arid region. It lies in the rain shadow of the Sierra Nevada Mountains and the coastal ranges of Southern California and receives less than 6 inches of annual precipitation. The Mojave Desert receives the largest portion of its annual precipitation in the winter months--October to March (Bailey 1954). The rainfall from these winter storms is a major factor in the geomorphic processes of the desert. It also is the primary source of water that supplies vegetation and springs. Fluctuations, therefore, in annual precipitation have a noticeable effect on the desert.

The average annual temperature in the Mojave Desert ranges is between 58° F. and 69° F. Seasonal temperatures can range 50° F. or more from the annual average. Temperatures drop well below freezing in the winter months, and climb as high as 120° F. or more in summer.

## Geology

The rocks of the Mojave region can be separated into two major divisions: a) Pre-Cenozoic rocks, and b) Cenozoic sedimentary and volcanic rocks. The Pre-Cenozoic rocks are composed of 1) metamorphic and old sedimentary rocks, and 2) igneous rocks.

Pre-Cambrian metamorphic and igneous rocks outcrop throughout the Mojave, but occur in major outcrops in the Sacramento Mountains, Old Woman Mountains, and a belt of mountains that parallel the California/Nevada border, extending northward to Death Valley. Paleozoic limestones and dolomites occur in only a few major outcrops, notably in the Providence Mountains and the Clark Mountains.

Mesozoic igneous rocks, particularly granites and Tertiary volcanic rocks, are the most common rocks in the mountains of the Mojave Desert. The rocks of Mesozoic age are generally coarse crystalline granites, believed to be emplaced contemporaneously with Sierra Nevada batholiths to the west. Tertiary volcanic rocks range from basaltic to rhyolitic in composition. Volcanism began during the Pliocene and continued into the early Quaternary. Basalt flows at Amboy Crater have been dated as recently as 6,000 years B.P. (Parker 1963).

Erosion has been a continuous process throughout the Cenozoic, resulting in large sections of Tertiary and Quaternary sediments. Quaternary lake beds in many of the valleys contain large deposits of saline minerals. Fossil pollens and other plant material recording changes in vegetation and climate are present in many of these sediments.

## Geomorphology

A major feature of the landscape of the project region is the pediment slopes, which are considered a geomorphic stratum in the sampling procedures. In describing the Quaternary conditions and geological interpretations of the Great Basin, Morrison (1965) includes this portion of the Mojave Desert as part of the Great Basin, and reviews the geological interpretation of these pediments and associated basins.

> The basins are partly filled with detritus from the adjoining mountains. The basin-fill deposits of the Quaternary age range in thickness from a few feet to several thousand feet. Gently sloping alluvial surfaces that are concave basinward border the mountains. These surfaces are of two types, which frequently occur in association. Bajada, or piedmont surfaces, the first type, are formed by coalescing alluvial fans and are underlain by relatively thick accumulations of gravelly alluvium laid down by floods debouching from the mountains. Pediment surfaces, the second type, are inclined rock-cut surfaces thinly veneered with gravelly alluvium. Down-slope, the pediments are overlapped by piedmont surfaces. Much of the Quaternary pedimentation took place before the last main climax of block faulting, and in places the pediments are displaced by the faults. In general, pediments are rather narrow in the northern part of the Great Basin and they become progressively wider to the south.
>
> The floors of basins that have remained closed decrease in slope toward the basin interior until they merge into almost level alluvial plains and

> finally in central playas (dry lakes) in the lowest part of the basin. Progressive alluviation has raised the floors, so that dissection and exposure in depth of the basin-fill deposits are slight. Commonly the upper parts of alluvial fans are dissected because of altered stream regimen resulting from climatic change or locally from uplift by block faulting. Some basins, however, have become breached and through-going drainage to lower basins has been established, and their basin-interior deposits have been dissected by the throughflowing stream and its tributaries (Morrison 1965:267).

The geologic processes which operate in the desert are not unique to the desert, but some are more or less effective due to the effects of the arid climate. Some, as faulting or warping, are independent of climatic conditions. Others, as weathering and the transportation of weathered material, are directly influenced by the nature and distribution of vegetation, which in turn are determined by climate (Blackwelder 1954).

## Weathering

The breakdown of rocks proceeds by means of mechanical and chemical processes. Thermal expansion, the freeze-thaw cycle, and salt crystal growth are the most common processes of mechanical weathering. In recent years chemical weathering, particularly crystal hydration, has been recognized as the major factor in the weathering of sound rocks in the desert.

Crystal hydration is basically an expansion of the crystal lattice by the addition of water. The expansion of the constituent crystals breaks the bonds between mineral grains, and the rock disintegrates into sand and rubble. "Exfoliation" is a common effect of hydration that results in sheets of crystals separating from the rock. Hydration is directly related to the amount of water available. Small cavities, or unusually porous section of rock, weather at a faster rate than surrounding rocks to enlarged niches and alcoves.

Of the mechanical weathering processes, thermal expansion and contraction, and wedge-work of the freeze thaw cycle are relatively minor compared to the action of salt crystal growth. The crystallization of salt, at or near the surface, has sufficient expansive force to break the bonds between individual grains of rock. Porous or fractured rocks, particularly those on or near saline playas, are rapidly disintegrated by this process. Nonporous rocks or very dense rocks are generally not affected.

Another process of weathering in the desert, that becomes important when considering recent changes in land forms, is desert varnish or patina. Desert varnish is a hard black coating consisting of oxides of iron and manganese, as well as fine wind borne clay particles "baked" on the rock surface. Desert varnish forms very slowly, and indicates areas that have been stable for long period of time. Blackwelder cites observations in Egypt that suggest a period of up to 5,000 years to form a light brown finish (1954:14).

## Stream and Wind Action

The primary resultant of running water and wind in the desert is the transportation of weathered material. The typical desert streams are rare floods which develop quickly and last only a few hours. These "flash floods" are infrequent events in which rainfall quickly runs off the barren mountainsides to concentrate in pre-existing channels. The run-off quickly gains a large volume and a high velocity, with great erosive power. The sediment load is then deposited on alluvial fans as the water loses velocity and permeates the porous alluvial gravel.

These floods strip away soil and rubble in their paths, as there is little or no vegetation to hold it in place. On steeper slopes running water excavates sharp ravines and gullies.

The phenomenon called "sheetwash" is the result of water from cloudbursts running over alluvial slopes in a "sheet", during which rain waters may accumulate to a depth of from a few inches to a few feet. Loose material is churned up from the ground surface so that the lower slopes become covered with detritus washed down from the upper alluvial slope. Related to the lack of a high degree of absorption in the project area's alluvial slopes, water from the sheetwash tends to flow down and empty into washes or arroyos. These distribute the water and debris into the dry lakes of the area. Certain locales within the project area exhibit classical examples of this type of removal of surface sands and gravels which leaves the alluvial slope surface with a denuded appearance. One such example of the effects of sheetwash is the slopes of the alluvial fan between the East and West Cronese Lakes and the western side of the Soda Mountains (Fenneman 1931).

The material deposited on alluvial fans and valley floors is rarely sorted and ranges from clay size particles to large cobbles. Wind action further separates this material by carrying off the finer portions, a process known as deflation. "Desert pavement" is a common result of deflation where the finer materials have been removed leaving a surface covered with coarse gravel and cobbles.

Wind action is an effective process in arid regions. Because vegetation is sparse, the wind can move fine gravel a few feet above the ground. Sand is carried much higher, and dust is lifted thousands of feet into the air where it can be carried long distances. Gravel is often swept into wind rows on playa surfaces. Sand is accumulated into dunes which migrate with the prevailing winds or deposit on the lee side of obstacles, from low shrubs to ridges or gullies.

Two major principles should be kept in mind in the observation of desert land forms. First, coarse granitic rocks are highly susceptible to weathering, and therefore relatively nonresistant. Second, due to the rapid concentration of runoff and the large amount of debris available for transport, running water has a major effect on the development of landforms.

## Quaternary Geology

In the Pleistocene, the last period of continental glaciation in the western hemisphere, the climate of the Mojave Desert was much different than it is today. The basins of the Mojave Desert contained extensive inland lakes. Vegetation at that time period ranged from grassland to woodland environments, occupied by numerous Pleistocene mammals (Maps 3, 4, and 5).

The Mojave River formed that master drainage, connecting several lakes and finally draining north into Lake Manly.

Ancient shorelines and other associated sediments indicate that these lakes covered tens to hundreds of square miles, and had depths of over two hundred feet (Blanc and Cleveland 1961).

## Recent Geologic History

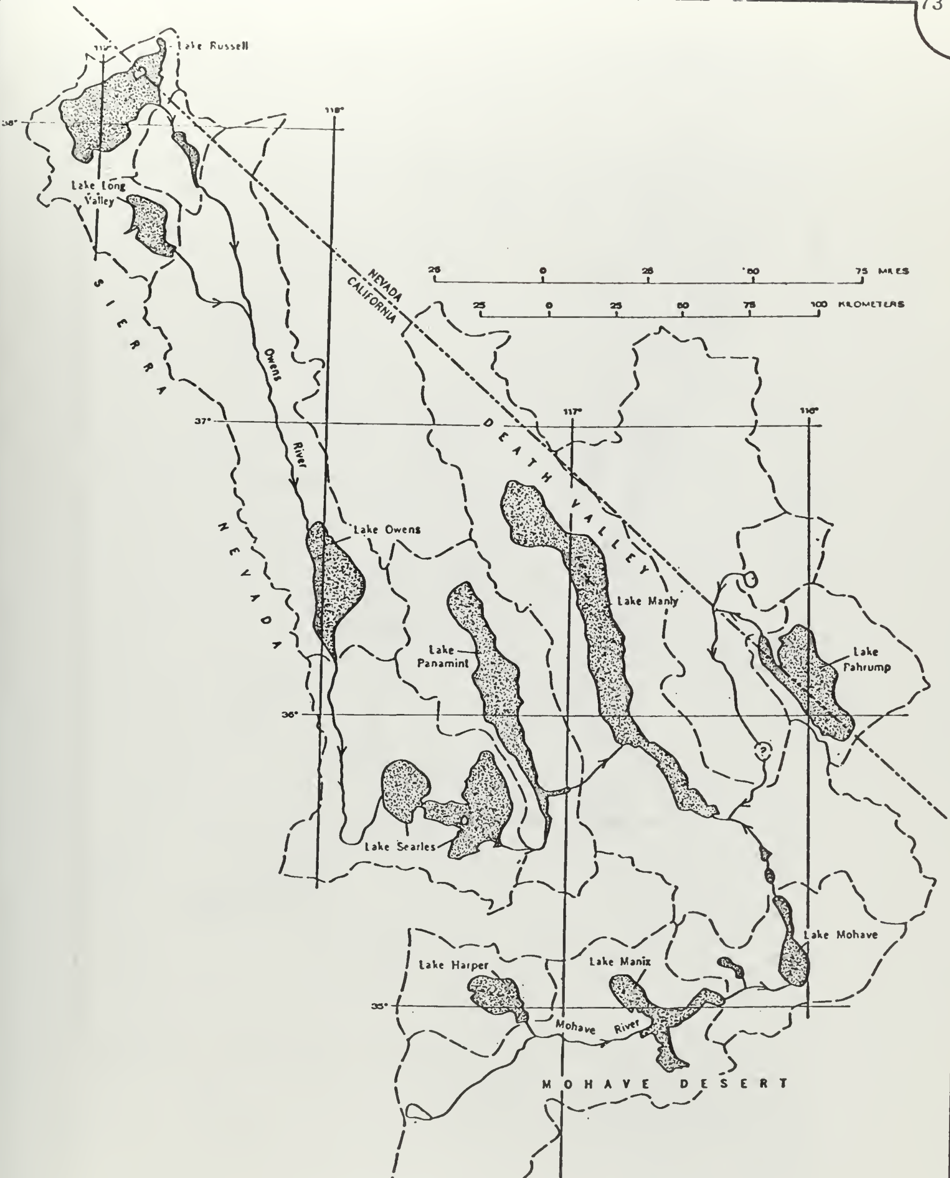
While the Mojave was not directly affected by glacial ice, glaciation in the Sierra Nevada Mountains along with world wide glaciation, brought about dramatic climatic changes within this region. The major drainage systems of the Mojave Desert are relics of the pluvial systems of the Pleistocene.

Four periods of glaciation in the Sierra Nevada Mountains have been recognized on the basis of soils formed in the Owens River Valley. In chronological order the four glacial periods are known as the McGee, Sherwin, Tioga and Tahoe glaciations. The Tahoe glaciation, the most recent, ended between 6,000 and 8,000 years ago. During interglacial phases the climate of the Mojave Desert probably became arid, similar to the present day conditions.

As a result of increased precipitation, related to the


Map 4

Map showing maximum expansion of the pluvial lakes and glaciers within the Great Basin during post-Sangamon time (after Morrison, 1965:266).




Map 5

Owens-to-Death Valley system of pluvial lakes, showing their maximum extent during post-Sangamon time, probably contemporaneous with the Tahoe glacial maximum (after Morrison, 1965:278).

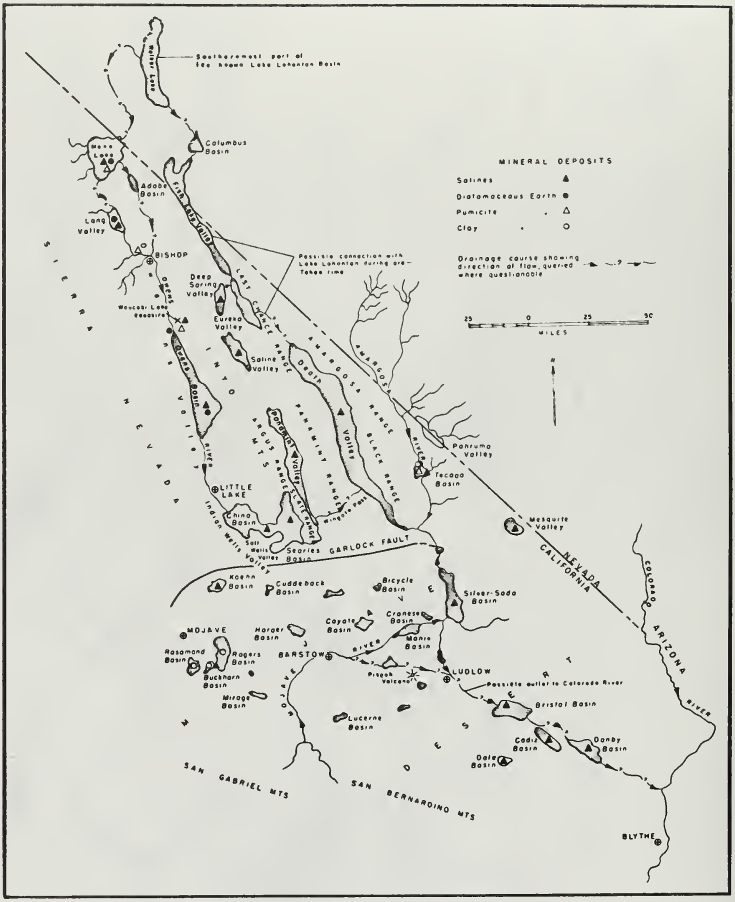



FIGURE 17-13 *Late Pleistocene freshwater lakes and rivers in the Great Basin and Mojave Desert. (California Division of Mines and Geology, Mineral Information Service, April, 1961.)*

Oakshott, Gordon B. California's Changing Landscapes. New York: McGraw-Hill (1971:323).

Map 6

glaciations, lakes developed in most of the basins within the Mojave Desert. Blanc and Cleveland (1961) describe the Mojave drainage as it had developed during the Pleistocene.

> Evidence of a Pleistocene lake along the Mojave River was first described by J.P. Buwalda in 1914. He discovered the well-exposed lake deposits that crop out along the river canyon near Manix, about 30 miles east of Barstow. To this former lake he gave the name Manix. Later work revealed that an arm of Lake Manix occupied the Afton Basin, where lake sediments, terraces and beach gravels are preserved. Vertebrate fossils, including eleven varieties of birds, indicate that the age of the Manix beds ranges from early to late Pleistocene. The Manix basin was for a long time the sump of the Mojave River and contained a large lake with fluctuating shorelines. At the time of its maximum extent it covered 200 to 300 square miles and was about 200 feet deep, but as the climate changed and the inflow decreased the lake disappeared leaving a playa. A dry period followed during which occasional floods regraded slopes to pediments and small fans were deposited on the lake deposits. With the return of a more moist climate, a second lake formed, and a new sequence of lake sediments was deposited. This lake flowed over its east rim into Afton Canyon. From Afton Canyon the water discharged eastward into the Silver-Soda Lake basin southeast of Death Valley to form ancient Lake Mojave and some drained northward and filled the Cronese basin and formed Little Lake Mojave. Well-preserved shore terraces and gravel bars indicate that Lake Mojave reached a depth of about 40 feet, then overflowed northward where its waters joined the Amargosa River before entering Death Valley. As only a small gorge was cut in the spillway it seems probable that the lake overflowed for only a short time, perhaps only a few centuries. The Mojave River still occasionally reaches Soda Lake and in 1916 Cronese and Silver Lakes were flooded to a depth of 10 feet. The Lake Manix spillway was cut down rapidly and eventually the lake was drained. Continued downcutting deeply dissected the Manix basin developing a system of dendritic canyons. Later the river was apparently dammed again forming a third lake. Much smaller in size than its predessors, this lake occupied only the canyons of the Afton Basin. This last lake was also drained, as indicated by the subsequent dissection of the basin by the Mojave River. Canyons nearly 200 feet deeper than the lake bottom now exist suggesting that pluvial conditons continued after the last lake drained.

> Geologists of the U.S. Geological Survey... recently have discovered several topographic benches, sand ridges and some "lake type" sediments near Crucero on the southern edge of Soda Lake basin. These features, which are believed to be of lacustrine origin, are significant because they occur at elevations between 955 and 1,111 feet, which is well above the 946 foot elevation of the Lake Mojave spillway. If there has been no post lake deformation of the spillway or of the lacustrine features it would appear that the Soda basin was the southern limit of a continuous lake which extended to the northern end of Death Valley--a distance of over 150 miles (Blanc and Cleveland 1961:5-6).

The other Pleistocene Lake which relates to the Southern Owlshead/Amargosa and Mojave Basin Planning Unit is Lake Manly.

> Lake Manly, the pluvial lake in Death Valley, was recognized by Russell and Gilbert, but was first accurately mapped by Blackwelder. It was fed by three separate drainage systems. The chief contributor was the Owens River-to-Death Valley system, from which Lake Searles and Panamint successively overflowed to Lake Manly only in Tahoe time. In addition, also probably in Tahoe time, a chain of pluvial lakes successively overflowed several basins in the Mohave Desert area and drained into Lake Manly via the Mohave River. The Amargosa River, which joins the Mohave River a short distance above Death Valley, at this time and subsequently contributed drainage from overflow of three more pluvial lake basins. At its maximum, Lake Manly was about 90 miles (145 km) long, 6-11 miles (10-18 km) wide, and nearly 600 ft (183 m) deep. Blackwelder...correlated the maximum with the Tahoe Glaciation because its deposits and shore features are almost erased by erosions ...(Morrison 1965:280).

<u>The Mojave Basin Drainage Hydrology</u>

While some of the general definitions of this area have been changed, Rogers' (1939) paper on this region, utilizing the geological analysis available at that time, is still as relevant and descriptive today as it was then.

> The Mohave is the longest river in the California desert area, and possesses one of the largest drainage areas. Although at present time the

lower half of its channel is usually dry, due to a high evaporation rate, insufficient run-off and the diversion of water for agricultural purposes, it often flows as far as its sink after a heavy storm or a winter of abnormal rainfall, and creates temporary lakes. In its lower course the river has cut a deep canyon through the beds of unconsolidated gravel, sand and clay which mark the position of the Pleistocene Manix Lake, and ancient catchment basin of the Mohave. From here the river gradient drops off rapidly for a distance of four miles through Cave Canyon (Afton Canyon) to the margin of the great Mohave Sink depression. Beginning at the mouth of Cave Canyon the Mohave has built a great delta of sand and gravel twelve miles long to the margin of Soda Lake. Judging from the evidence of well-logs, the delta must extend even out beneath the Soda Lake playa surface. On the apex of the deltaic cone the drainage divides into two channels, one leading in a northwesterly direction into East Cronise Lake which overflows into West Cronise Lake when there is sufficient volume, and the other to Soda Lake to the east. Here the drainage splits again into several shallow meandering channels. At the north end of Soda Lake the flood waters converge into a single narrow channel, which cuts through a low gravel divide and flow into Silver Lake. All four of these catchment-basins have approximately the same elevation, and together form the Mohave Sink.

Today the direction of the flow of the Mohave is delicately balanced at its point of emergence from Cave Canyon by shifting sand dunes and the deposition of the alluvial load borne by the stream. Sometimes the flow is into the Cronise Lake's sector, sometimes into the Soda and Silver Lakes area; and when the flow is great as in 1916, water flows into all four depressions. The flood of 1916 created lakes ten feet deep in both the Cronise and Silver Lake basins, which lasted a year and a half before becoming dessicated by evaporation and percolation. According to the available records (official and unofficial) this condition has prevailed throughout historic times (Rogers 1939:37).

Rogers also reported that in 1939 the Mohave River flooded and brought the East Cronese Lake up to the five foot level. This type of flooding has been paralleled a number of times since this date, and in 1978 the five foot level of water was reached in East Cronese Lake. There was not sufficient water to overflow into the West Cronese Lake in appreciable amounts.

> Although the present catchment area of the terminal flow of the Mohave, which in the aggregate is referred to as the Mohave Sink, can be considered with a certain exactitude, insofar as present and near-recent physiographic relations are concerned, the earlier conditions with the Sink are far from being clear. Beaches, wave-cut headlands and tufa deposits indicate clearly the former presence of two large lakes within the Sink. For the ancient lake which covered the Silver Lake depression and most of the Soda Lake depression, Thompson has suggested the Mohave Lake, and for the one embracing the two Cronise Valleys, Little Mohave Lake (Rogers 1939:38).

In an overview of the hydrology from south to north within the project region, there are nine existing major catchment basins or playas (Map 3). Of these, four are directly related to the Mojave River drainage system, and these are Soda Lake (ca. 17,280 acres), East (ca. 1,570 acres) and West (ca. 1,570 acres) Cronese Lakes and Silver Lake (ca. 7,680 acres). There is some geological evidence that during the Pleistocene epoch the Silver Lake overflow reached as far north as the unnamed dry lake that is north of the Silver Lake outlet, Silurian Lake and eventually into Pleistocene Lake Manly in Death Valley. The Pleistocene Lake system has already been discussed and this section is essentially concerned with the relatively recent hydrological conditions.

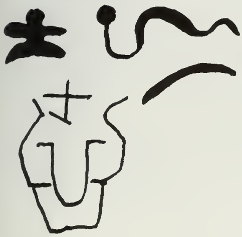
The remaining five playas not involved with the Mojave River system, include Broadwell Lake (ca. 2,560 acres), an unnamed dry lake (ca. 640 acres) just south of the Mesquite Hills, Red Pass Lake (ca. 1,280 acres), the unnamed dry lake (ca. 1,920 acres) north of Silver Lake, and Silurian Lake (ca. 1,920 acres), all of which today are internal drainages.

Currently in times of sufficient rainfall Broadwell Lake will have a surface cover of water. The basin is primarily filled by runoff from the Bristol Mountains to the east, the Cady Mountains to the west and the Bullion Mountains to the south. The unnamed dry lake south of the Mesquite Hills (T11N, R8E, Section 31 and 32) is apparently filled mainly by runoff from the Bristol Mountains and a large arroyo system that drains into the dry lake. The major source of runoff for the Red Pass Lake appears to be the western slopes of the Avawatz Mountains. The unnamed lake (T16N, R8E, Section 6, 31 and 30) receives the drainage from the eastern slopes of the Avawatz Mountains. Silurian Lake is fed by the Silurian Hills in part, the eastern slope of the Avawatz Mountains and Salt Creek.

While the project region contains these five large playas of internal drainage, and four playas that are part of the Mojave River drainage system, there is an almost complete lack of known springs. There are only four springs located within the study area. Of these, three have no recorded archaeological materials present, either because the springs had been developed historically to such an extent as to destroy the prehistoric evidence, or that there had been little to no prehistoric use. The springs include Soda Springs, Old Mormon Springs, an unnamed spring south of Soda Springs and a spring called Tomaso Spring that was not located. A Dante Springs was reported within the area, but its existence could not be confirmed by the field survey. This paucity of springs as an integral aspect of the region would have affected aboriginal prehistoric use patterns. From the number of historic wells that exist (see page 80 ), there was sub-surface water, but whether it was ever utilized prehistorically cannot be determined.

As mentioned previously, there is geological evidence of extensive Pleistocene lakes in the northern part of the study area. Some of these playas, dependent upon climatic conditions, have been known to fill in historic time, and even during the survey water was evident in Silver Lake, East Cronese Lake, a small amount in West Cronese Lake and some water in Broadwell Lake. The water in East Cronese Lake is presently diverted from the Mojave River by a railroad dike, and during the survey period was filled to its highest visible strand line.

As a background for understanding the hydrology of the project area, a spring and well-log is included. This information was derived from a report by Judyth Reed (1977), "Springs of the Mojave Basin, Amargosa and Bitterwater Area", that is on file with the BLM, Riverside. The paucity of natural springs in this region is immediately apparent through a perusal of the log, and relates to the distribution and density of archaeological sites.



Petroglyphs from Two Springs in the Owlsheads on the left, and from Cave Springs in the Avawatz Mountains, on the right. After Rogers field notes. Illustrations by Russell L. Kaldenberg.

Avawatz Pass

Name -- Old Mormon Spring
Elevation -- 3,000 ft.
Location -- T16N/R7E SE/SW of 32

Silurian Hills

Name -- Dry well (dry)
Elevation -- 690 ft.
Location -- T17N/R8E NE/SE of 32
General Area -- 3/4 miles east of RR grade + BM/102

Red Pass Lake

None - 1 outside unit.

Baker

Name -- None
No./Type -- Well
Elevation -- 1,000 ft.
Location -- T12N/R8E SW/SE of 15
General Area -- Mile east North end Silver Lake

Name -- None
No./Type -- Well
Elevation -- 940 ft.
Location -- T14N/R8E SE/SW of 30
General Area -- Baker

Name -- None
No./Type -- Well
Elevation -- T14N/R8E center sec. 14
General Area -- So. of So. East curve of Silver Lake

Name -- None
No./Type -- Well (dry)
Elevation -- 900 ft.
Location -- T14N/R8E SE/SE of 13

Name -- Well #1
Elevation -- 1000 ft.
Location -- T15N/R8E NE of 22
General Area -- 1 mile NE of N end of Silver Lake
Additional -- Windmill - 64' deep.

Name -- Well #2
Elevation -- 1,000 ft.
Location -- T15N/R8E NE? of 22
General Area -- Near Baker?
Additional -- Windmill

* Numbered wells were recorded by Thompson, and Old Mormon Spring and Cronese Spring by Mendenhall (see Bibliography).

Baker (continued)

Name -- Well #6
No./Type -- 1 well - dug
Elevation -- 1000 ft.
Location -- T14N/R8E NE of 36
General Area -- 1 mile south west of Baker
Depth -- 36.5 ft.
Measured -- September 9, 1917
Lift -- Jack pump - pumps nearly dry
Yield -- 7 gals/min.
Source -- Thompson, 1929, p. 524 & pl. 28.

Name -- Tomaso Springs
No./Type -- several springs
Elevation -- Uncertain
Location -- Uncertain
General Area -- Northwest end of Soda Mountains
Additional -- Water of good quality.
Source -- Mendenhall 1909: 55.

Name -- Dante Springs
No./Type -- 1 spring
Elevation -- Approx. 1120 ft.
Location -- Probably T13N/R9E SE of 28 - uncertain.
General Area -- On north side of Butte at Northeast end of Soda Lake.
Source -- Mendenhall 1909: 62.

Soda Lake Quad

Name -- None
No./Type -- 1 well
Elevation -- 1077 ft.
Location -- T11N/R7E NW/SW of 14
General Area -- Approximately 1 mile south of Union Pacific RR Line.

Name -- None
No./Type -- 1 well
Elevation -- 1200 ft.
Location -- T12N/R7E NE/SW of 36
General Area -- North side of Mojave River Wash

Name -- None
No./Type -- 1 well
Elevation -- 1000 ft.
Location -- T11N/R7E SW/SW of 6
General Area -- Mojave River Wash

Name -- None
No./Type -- 1 spring - alkali
Elevation -- 1100 ft.
Location -- T12N/R8E NE/NE of 22
General Area -- 1 mile Southeast of Soda Mountains.

Soda Lake Quad (continued)

Name -- Soda Springs
No/Type -- 3 springs (alkali)
Elevation -- 800 ft.
Location -- T12N/R8E
General Area -- East side of Soda Mountains, west shore of Soda Lake.
Additional -- Limestone? Water highly mineralized, especially sodium chloride. Poor for irrigation. Can be used for drinking if necessary. Water 75°F.
Source -- Thompson, 1929, p. 130 & 529.

Name -- Devil's Well #1
No/Type -- 1 well
Elevation -- 950 ft.
Location -- T12N/R8E SE/SE
General Area -- 1½ miles South of Soda Lake.
Additional -- 103-ft. drilled well, limestone. Water 78½°F. Possibly same well Thompson calls Soda Station Well #1.
Source -- Thompson, 1929, p. 130 & 524.

Name -- Devil's Well #2
No/Type -- 1 well
Elevation -- 960 ft.
Location -- T12N/R8E NE/NE of 35
General Area -- Approximately ½ mile South of Devil's Well #1.
Additional -- 39-ft. drilled well, limestone. Water 73½°F. Possibly same well Thompson calls Soda Station Well #1.
Source -- Thompson, 1929, p. 130 & 524.

Name -- None
No/Type -- 1 well
Elevation -- 900 ft.
Location -- T12N/R8E NW/NE of 4
General Area -- Between East shore of Soda Lake and West side of Little Cowhole Mountain.

Name -- None
No/Type -- 1 well
Elevation -- 900 ft.
Location -- T12N/R9E NW/SE of 4
General Area -- Approximately ½ mile East of Soda Lake.

Name -- Mesquite Spring
No/Type -- 1 spring
Elevation -- 1200 ft.
Location -- T11N/R7E SE/SE of 25
General Area -- Northwest tip of Mesquite Hills.

<u>Soda Lake Quad</u> (continued)

| | | |
|---|---|---|
| Name | -- | Mesquite Spring (continued) |
| Additional | -- | Ganite? Thompson reported no flow. Water 56°F. Water very highly mineralized. Very bad, if not unfit for domestic use. Several people were reported ill after drinking. Poor for irrigation. |
| Source | -- | Thompson, 1929, p. 131, 528. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | 1 spring |
| Elevation | -- | 1080 ft. |
| Location | -- | T11N/R7E SE/SE of 25 |
| General Area | -- | North side of West end of Mesquite Hills, 1/3 mile East of Mesquite Spring. Water much like Mesquite Spring. |
| Source | -- | Thompson, 1929, p. 131, 529. |

| | | |
|---|---|---|
| Name | -- | Epsom Spring |
| No/Type | -- | 1 spring |
| Elevation | -- | 1487 ft. |
| Location | -- | T11N/R8E NE/SW of 21 (?) |
| General Area | -- | South of Soda Lake. Alluvium, water 62°F. |
| Source | -- | Thompson, 1929, p. 131, 529. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | 1 windmill |
| Elevation | -- | 940 ft. |
| Location | -- | T13N/R8E SE/NE of 12 |
| General Area | -- | East Shore of North tip of Soda Lake. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | 1 windmill |
| Elevation | -- | 960 ft. |
| Location | -- | T21N/R9E SE/NW of 22 |
| General Area | -- | East Shore of Southern end of Soda Lake. |

The following wells are numbered according to Thompson, 1929, pp. 224-25, & pl. 28.

| | | |
|---|---|---|
| Name | -- | Well #7 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 922 ft. |
| Location | -- | T13N/R8E West ½ of 1 |
| General Area | -- | North end of Soda Lake. |

| | | |
|---|---|---|
| Name | -- | Well #9 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1000 ft. |
| Location | -- | T13N/R8E SE? of 1 |
| General Area | -- | North end of Soda Lake |
| Depth | -- | 400 ft. |
| Additional | -- | Water brackish. |

<u>Soda Lake Quad</u> (continued)

| | | |
|---|---|---|
| Name | -- | Well #10 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 950 ft. |
| Location | -- | T12N/R8E 11 |
| General Area | -- | West shore of Soda Lake |
| Depth | -- | 103 ft. |
| Measured | -- | September 9, 1917<br>December 11, 1919 |
| Additional | -- | Limestone struck at 15 feet, flowing water at 25 ft. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 950 ft. |
| Location | -- | T12N/R8E 11 |
| General Area | -- | West shore of Soda Lake |
| Depth | -- | 39 ft. |
| Measured | -- | September 9, 1917<br>December 7, 1919 |
| Additional | -- | A third well at this place is partly clogged. |

| | | |
|---|---|---|
| Name | -- | Well #12 |
| No/Type | -- | 1 well - dug |
| Elevation | -- | 950 ft. |
| Location | -- | T12N/R8E SW of 27 |
| General Area | -- | 2 miles SW of Soda Lake. |
| Depth | -- | 14.8 ft. |
| Measured | -- | December 7, 1919 |
| Lift | -- | Duplex? |
| Additional | -- | 24 X 55 ft. in area. |

| | | |
|---|---|---|
| Name | -- | Well #13 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1080 ft. |
| Location | -- | T11N/R7E NW of 11 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 143.2 ft. |
| Measured | -- | December 12, 1919 |
| Additional | -- | Best water in area (Thompson) |

| | | |
|---|---|---|
| Name | -- | Well #14 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1080 ft. |
| Location | -- | T11N/R7E SE of 11 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 99 ft. |
| Measured | -- | December 5, 1919 |

Soda Lake Quad (continued)

Name -- Well #15
No/Type -- 1 well - drilled
Elevation -- 1080 ft.
Location -- T11N/R7E NE of 14
General Area -- Mojave River Wash, along Union Pacific RR.
Measured -- December 15, 1919

Name -- Well #16
No/Type -- 1 well - drilled
Elevation -- 1080 ft.
Location -- T11N/R7E NW of 14
General Area -- Mojave River Wash, along Union Pacific RR.
Source -- U.S. Water Supply paper #224, p. 524 & pl. 28.

Name -- Well #17
No/Type -- 1 well, dug and drilled
Elevation -- 1060 ft.
Location -- T11N/R7E NE of 14
General Area -- Mojave River Wash, just East of Union Pacific RR.
Depth -- 33 ft.
Measured -- December 12, 1919
Source -- Thompson, 1929, p. 524 & pl. 128.

Name -- Well #18
No/Type -- 1 well
Elevation -- 1040 ft.
Location -- T11N/R7E NE of 24
General Area -- Mojave River Wash, 2 miles North of Mesquite Hills.
Depth -- 12 ft.
Source -- Thompson, 1929, p. 524 & plate 28.

Name -- Well #19
No/Type -- 1 well - drilled
Elevation -- 1040 ft.
Location -- T11N/R8E SW of 6
General Area -- Mojave River Wash
Depth -- 81 ft.
Source -- Thompson, 1929, p. 524 & plate 28.

Name -- Well #20
No/Type -- 1 well - drilled
Elevation -- 1040 ft.
Location -- T11N/R8E NW of 7
General Area -- Mojave River Wash
Depth -- 74 ft. Originally 81 ft. deep.
Measured -- December 7, 1919
Source -- Thompson, 1929, p. 524 & plate 28.

Soda Lake Quad (continued)

| | | |
|---|---|---|
| Name | -- | Well #21 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1040 ft. |
| Location | -- | T11N/R8E NW of 7 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 23 ft. |
| Lift | -- | Hand Pump |
| Flow | -- | 20 gal/min. |
| Measured | -- | December 7, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #22 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1040 ft. |
| Location | -- | T11N/R8E NE of 7 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 81 ft. |
| Measured | -- | December 7, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #23 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1040 ft. |
| Location | -- | T11N/R8E SE of 7 |
| General Area | -- | Mojave River Wash, ½ mile North of Union Pacific RR. |
| Depth | -- | 150 ft. |
| Lift | -- | Horizontal centrifugal |
| Flow | -- | 225 gals/min. |
| Measured | -- | December 16, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #24 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1000 ft. |
| Location | -- | T11N/R8E NW of 9 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 74 ft. |
| Measured | -- | December 6, 1919 |
| Source | -- | Thompson, Geological Water Supply Paper, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #25 |
| No/Type | -- | 1 well - dug |
| Elevation | -- | 1020 ft. |
| Location | -- | T11N/R8E SE of 8 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 13 ft. |
| Measured | -- | December 6, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

Soda Lake Quad (continued)

| | | |
|---|---|---|
| Name | -- | Well #26 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1020 ft. |
| Location | -- | T11N/R8E SW of 8 |
| General Area | -- | Mojave River Wash, ½ mile East of Crucero. |
| Depth | -- | 87 ft. |
| Measured | -- | December 6, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #27 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1000 ft. |
| Location | -- | T11N/R8E SW of 9 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 104 ft. |
| Measured | -- | December 6, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #28 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1000 ft. |
| Location | -- | T11N/R8E SW of 10 |
| General Area | -- | Mojave River Wash |
| Depth | -- | 276 ft. |
| Lift | -- | Horizontal centrifugal |
| Flow | -- | 160 gals/min. |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #29 |
| No/Type | -- | 1 well - dug |
| Elevation | -- | 1020 ft. |
| Location | -- | T11N/R8E NE(?) of 17(?) |
| General Area | -- | Mojave River Wash, North end of Crucero Hill. |
| Measured | -- | December 6, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #30 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1020 ft. |
| Location | -- | T11N/R8E NE of 18 |
| General Area | -- | Crucero |
| Depth | -- | 154 ft. |
| Lift | -- | Horizontal centrifugal |
| Measured | -- | December 7, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

Soda Lake Quad (continued)

| | | |
|---|---|---|
| Name | -- | Well #31 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1020 ft. |
| Location | -- | T11N/R8E NE of 18(?) |
| General Area | -- | Crucero |
| Depth | -- | 91 ft. |
| Lift | -- | Horizontal Centrifugal |
| Flow | -- | 100 gal/min. |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #32 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1040 ft. |
| Location | -- | T11N/R8E NW of 19 |
| General Area | -- | Mojave River Wash, 1 mile East of Crucero Hill. |
| Depth | -- | 86 ft. |
| Measured | -- | December 2, 1919 |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #33 |
| No/Type | -- | 1 well - dug |
| Elevation | -- | 1040 ft. |
| Location | -- | T11N/R8E NE(?) of 29(?) |
| General Area | -- | Southwest tip of Crucero Hill |
| Depth | -- | 12.6 ft. |
| Measured | -- | December 9, 1919 |
| | | Water slightly salty. Well is 100 yards North of rock hills. |
| Source | -- | Thompson, 1929, p. 525 & plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #44 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1080 ft. |
| Location | -- | T11N/R7E NW of 33 |
| General Area | -- | 2 miles East of Cave Mountain |
| Depth | -- | 70 ft. |
| Measured | -- | December 3, 1919 |
| Lift | -- | Handpump |
| Source | -- | Thompson, 1929, p. 525 and plate 28. |

| | | |
|---|---|---|
| Name | -- | Well #45 |
| No/Type | -- | 1 well - drilled |
| Elevation | -- | 1300 ft. |
| Location | -- | T11N/R6E SE of 18 |
| General Area | -- | Soda Mountains |
| Depth | -- | 429 ft. |
| Measured | -- | August 1904 |
| Source | -- | Thompson, 1929, p. 525 and plate 28. |

<u>Cave Mt.</u>

| | | |
|---|---|---|
| Name | -- | Bitter Spr. (outside unit) |
| Elevation | -- | 1,400 ft. |
| Location | -- | T13N/R5E SW/SW of 10 |
| General Area | -- | Approx. 1 mile West of Military boundary. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Spring |
| Elevation | -- | 1082 ft. |
| Location | -- | T12N/R6E NE/SW of 3 |
| General Area | -- | North tip of West Cronese Lake |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Spring |
| Elevation | -- | 1408 ft. |
| Location | -- | T11N/R6E SE/SE of 18 |
| General Area | -- | Afton |

| | | |
|---|---|---|
| Name | -- | Well #35 |
| Elevation | -- | 1080 ft. |
| Location | -- | T12N/R7E SW of 17 |
| General Area | -- | East end of East Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Well #36 |
| Elevation | -- | 1080 ft. |
| Location | -- | T12N/R7E NE of 19 |
| General Area | -- | SE shore of East Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Well #37 |
| Elevation | -- | 1100 ft. |
| Location | -- | T12N/R7E SE of 20 |
| General Area | -- | Approx. 1 mile SE of East Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Well #38 |
| Elevation | -- | 1100 ft. |
| Location | -- | T12N/R7E SE of 20 |
| General Area | -- | Approx. 1 mile SE of East Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Well #39 |
| Elevation | -- | 1090 ft. |
| Location | -- | T12N/R7E SW of 20 |
| General Area | -- | Approx. 1 mile South of East Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Well #40 |
| Elevation | -- | 1080 ft. |
| Location | -- | T12N/R7E NW of 30 |
| General Area | -- | Cronese Lake halfway between East Cronese & Cave Mt. |

| | | |
|---|---|---|
| Name | -- | Well #41 |
| Elevation | -- | 1235 ft. |
| Location | -- | T12N/R7E SW of 29 |
| General Area | -- | NE tip Cave Mt. |
| Additional | -- | windmill |

Cave Mt. (continued)

| | | |
|---|---|---|
| Name | -- | Well #42 |
| Elevation | -- | 440 ft. |
| Location | -- | T12N/R7E  SE of 29 |
| General Area | -- | ½ mile East of NE tip of Cave Mt. |

| | | |
|---|---|---|
| Name | -- | Well #43 |
| Elevation | -- | 1230 ft. |
| Location | -- | T12N/R7E  NW of 32 |
| General Area | -- | ½ mile SE of NE tip of Cave Mt. |

| | | |
|---|---|---|
| Name | -- | Well #45 |
| Elevation | -- | 1415 ft. |
| Location | -- | T12N/R7E  SW of 28 |
| General Area | -- | 2 miles East of Cave Mt. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 1577 ft. |
| Location | -- | T11N/R5E  SW/NE of 15 |
| General Area | -- | Mojave River Wash at Dunn. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 1570 ft. |
| Location | -- | T11N/R5E  NE/SE of 10 |
| General Area | -- | Mojave River Wash at Dunn. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 1580 ft. |
| Location | -- | T11N/R5E  SW/SW of 11 |
| General Area | -- | Mojave River Wash at Dunn. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 1600 ft. |
| Location | -- | T11N/R5E  NE/NE of 14 |
| General Area | -- | Mojave River Wash at Dunn, 2 miles West of Afton. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 1086 ft. |
| Location | -- | T12N/R6E  SE/NE of 4 |
| General Area | -- | 1 mile NW of West Cronese Lake. |

| | | |
|---|---|---|
| Name | -- | Cronese Spring |
| Elevation | -- | ? |
| General Area | -- | SE end of Cronese Dry Lake + SW base of Soda Lake Mt. |

## Old Dad

No springs.

## Rodman Mt.

2 springs are outside area.

## Cady Mt.

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well |
| Elevation | -- | 2655 ft. |
| Location | -- | T10N/R5E NW/NW of 32 |
| General Area | -- | SE edge of Dry Lake. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Windmill (well?) |
| Elevation | -- | 1852 ft. |
| Location | -- | T9N/R5E SW/NW of 32 |
| General Area | -- | 2 miles N of ATSF RR line. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Windmill (well?) |
| Elevation | -- | 2000 ft. |
| Location | -- | T10N/R5E SE/SW of 1 |
| General Area | -- | ½ mile North of ATSF RR line. |

## Broadwell Lake

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well (aband.) |
| Elevation | -- | 1298 ft. |
| Location | -- | T9N/R7E SW/NE of 13 |
| General Area | -- | Approx. ¼ mile North of North shore of Broadwell Lake near Broadwell. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well (aband.) |
| Elevation | -- | 1298 ft. |
| Location | -- | T8N/R8E NW/SW of 5 |
| General Area | -- | South tip of Broadwell Lake. |

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Tank |
| Elevation | -- | 2800 ft. |
| Location | -- | T10N/R8E SW/NE of 36 |
| General Area | -- | Approx. 2 miles NW of Broadwell Mesa. |

## Lavic

No Springs

## Ludlow

| | | |
|---|---|---|
| Name | -- | None |
| No/Type | -- | Well (dry) |
| Elevation | -- | 2111 ft. |
| Location | -- | T7N/R8E SW/SW of 33 |
| General Area | -- | 1 mile South of Ragtown. |

## Bagdad

No Springs

Photograph of Bitter Springs looking towards the west and Red Pass Lake. Photo taken by Russell L. Kaldenberg, June 1979.

# SECTION 4

## BIOTA OF THE AMARGOSA BASIN-MOJAVE DESERT

The biota of the Amargosa Basin-Mojave Desert is classified predominately as Lower Sonoran life zone. Both plants and animals observed during the survey are typically found in the Mojave Desert below 4,000 ft elevation. Saltbush, dune, and spring riparians form ecotonal mosaics within this desert scrub vegetation type. Floral and faunal data was interpreted for 96% of the study units. Floral observations included both annual and perennial species. Faunal recordings included both actual sightings and indications of animals through rodent holes or scotalogical evidence. Plant growth and animal populations are regulated by hydrologic patterns throughout the year and aboriginal adaptation was intricately linked to this seasonality of the ecosystem which usually yielded low population densities. The ethnographically known mobility of these desert peoples does indicate that higher elevations were used for food procurement, spring utilization and escaping the summer heat. As Laird (1978:104) states "...the Chemehuevis were most familiar with the plant life of high and low deserts, but these wide-ranging people were also well acquainted with whatever grew in the mountains and foothills, around streams and waterholes, and in the river floodplain."

Vegetational analysis lists creosote as the dominant, or co-dominant, species. Creosote was reported in over 89% of the transect units surveyed. Burro weed or bursage is listed as the second major occurring plant. In the lower elevations, on the playas, the alkalai sink riparian typifies the vegetation type; Salt Bush, iodine bush and seep weed are the major plants in the subcommunity. Approximately 20% of the units surveyed lie in this salt tolerant environment.

In the Mojave Basin region typified by sand dunes, mesquite trees dominate the environment. Other plants usually associated with these areas include rice grass and evening primrose. Numerous annuals were noted through the study area and often formed the highest frequencies for a particular unit. Many composites, including brittle bush, cheese bush and goldenray coupled with Indian millet and Indian rice grass composed the bulk of these annual plants. Annuals may have been noted in unusually high frequencies due to the high amounts of precipitation during the 1977-1978 winter. Remnant populations of yucca occur at the higher elevations of the study area, but no concentrations were observed in any of the units surveyed. Some typically high elevational plants such as Apache plume or the lime-green joint fir were noted in wash or cliff riparians, but

again formed a small percentage of the overall vegetation pattern.

Faunal observations recorded by survey crews resulted in high frequencies of black ants, grasshoppers, song birds, and rodent holes. Lizards and jack rabbits were also commonly noted. Ground squirrels, red ants, beetles, and cottontail rabbits were in evidence, but not in abundance. Isolated or rare sightings of horned lizards, coyotes, rattlesnakes, pack rats, an owl, and a few desert tortoise completed the faunal listings. Animals that may occur in the study area but were not noted include deer, mountain sheep, chuckwallas, pocket mice, worms and larva. Aboriginal populations exploited the fauna throughout the year. Food, clothing and ornamentation were procured from various animals either by trapping, hunting or communal drives.

The following comprise various uses of plants and animals by the many cultures that lived in the Mojave Desert region.

## Ethnobotanical Considerations

The Mojave Desert provides a wide variety of utilizable plants available throughout the year to various cultures in ethnohistoric and prehistoric times. Common plants known for their abundance, palatability or medicinal value include mesquite, Indian rice grass, pickleweed, evening primrose, beavertail, cholla, barrel cactus, creosote, desert lily, various sunflowers and Morman tea.

One of the most important edible plants to many desert cultures was the mesquite tree. The Cahuilla Indians heavily utilized mesquite pods for gruel, unleavened cakes, or drinks (Bean 1972). The mesquite meal could be stored for long periods of time in baskets or granaries. Castetter and Bell (1951) mention that the Lower Colorado River groups used large granary baskets five to six feet across and four to five feet high. The value of mesquite is further evidenced among these people by the fact that there was ownership of the groves by certain sibs or groups. The actual owning group among the Cahuilla for a grove was the lineage, although individual families within the lineage owned particular trees. A final indication of the importance of mesquite to the Cahuilla was the naming of the seasons based on the phenology of the plant. Eight different stages or period were recognized by the Cahuilla (Bean 1972). The Chemehuevi, like many other groups in the Mojave Desert, also valued mesquite beans. The seed of the mesquite was prepared for eating by parching the bean by shaking them in a basket with hot coals (Laird 1976). Although Laird does not elaborate to the use of the screwbean mesquite, the names of

both the plant and the fruit are given indicating a relationship to the Chemehuevi. Among the tribes on the Colorado and Gila Rivers mesquite and screwbean pods constituted the chief source of wild food (Castetter and Bell 1951). In sum, mesquite was one of the most important plants for its religious and social functions which related directly to its gastronomical value.

Indian rice grass was prepared similarly to mesquite. The seeds were ground to make a mush or eaten raw. The abundance of rice grass coupled with its availability throughout much of the year made the plant an important support food to many aboriginal desert cultures. Castetter and Bell (1951) report that the seeds from four identified grasses were utilized by all the tribes on the Lower Colorado.

Salt bush and Quail bush are other plants that when ground into flour could be stored for long periods of time. The nutlets, or fruit, are available throughout much of the year. In many of the units surveyed during the study Salt bush was the dominant species. Usually found in areas of high alkalinity, these plants produce an abundance of carbohydrate energy for many months of the year. Among the Colorado River tribes Quail bush and Salt bush were both collected in November, pounded and winnowed several times before being made into a mush. The Quail bush was prepared by pit-baking, parched and ground on a metate and made into gruel (Castetter and Bell 1951).

Various cacti were used by many southwest and Great Basin cultures and were available throughout the year in the Mojave Desert. Laird (1976) reports that the new branch just budding out from the Cholla is edible and has a jelly-like texture when cooked. According to Castetter and Bell (1951) the desert Maricopa utilized particularly the pit-baked sourish flower buds of Opuntia gathered in May. The stems or pods of cholla, beavertail, prickly pear, and barrel cacti were boiled and eaten as a vegetable. The Mohave, Cocopa, and Maricopa utilized both prickly pear and cholla. Fruits, or "tunas" were rolled on the ground to remove the spines and eaten raw (Castetter and Bell 1951). The seeds of the cactus fruit, although very hard, were also eaten, and have high amounts of protein (Felger 1976).

Pickleweed and iodine bush, two more phreatophytes, are also available throughout the year in the Mojave Desert. The small black seeds of iodine bush were gathered in December by the Mohave, Yuma, and Maricopa after frost and prepared and utilized in the customary manner for seeds (Castetter and Bell 1951). The succulent stems of these two plants were gathered and used either raw in salads, or boiled in soups and stews. The abundance of these two

plants added variety to the aboriginal diet.

Numerous annual sunflowers (family--Compositae) occur in high frequencies in the Mojave Desert, dependent on the rainfall during the winter months. The abundant seeds from plants such as brittle bush, desert sunflower, common sunflower, sunray, paper flower, and brikellia were ground on a metate to make a storable flour. On the lower Colorado, the Mohave gathered the seeds from wild sunflowers, winnowed, parched and ground them into a meal and ate them as pinole. Four Mohave informants reported that some families planted sunflower seeds much like corn. Little attention was given to the seeds, for they grew rapidly (Castetter and Bell 1951). The nutritious seeds of the sunflower contain as much as 43% protein and 54% oil (Bean 1972).

Many plants were utilized for medicinal purposes, but only a few have any pharmacological basis for theraputics. Of particular interest is Ephedra, Mormon tea or joint fir. Aboriginals reported the value of the plant in curing coughs and colds. C. K. Chang, Indiana University, isolated the active compound, ephedrine, from Ma-hu-ong, the Chinese equivalent of Mormon tea. Ephedrine is now used as the active ingredient of antihistamines. Creosote bush, sometimes called greasewood, was and is one of the great medicinal plants of the Chemehuevi (Laird 1976). It is classified as a substance which ordinary folk apply to themselves or to others. Creosote was considered an almost universal panacea. The leaves were made into a tea for bowel problems and consumption. A gum was obtained from the bark and applied to wounds and sores (Mead 1972). The gum was also used as a sealant for pottery vessels, and was mentioned in one of the Chemehuevi myths as an adhesive (Laird 1976).

Other plants observed during the survey were also used as food, medicine and for construction. Only those plants that were recorded within survey transects were chosen for inclusion in this section of the Inventory Report. Most desert cultures in aboriginal North America utilized in excess of one hundred species for various purposes. The variable food plants available coupled with protein from animal sources made for a healthy and nutritional diet.

The following plants constitute those species observed and recorded in the transects during the survey.

| | |
|---|---|
| Creosote | *Larrea tridentata* |
| Burro bush | *Ambrosia dumosa* |
| Beaver tail cactus | *Opuntia basilaris* |
| Jumping cholla cactus | *Opuntia bigelovii* |
| California poppy | *Eschscholtzia Parishii* |
| Primrose | *Oenothera deltoides* |
| Pickleweed | *Allenrolfea occidentalis* |
| Iodine bush | *Suaeda torreyana* |
| Winter fat | *Eurotia lanata* |
| Desert trumpet | *Eriogonum inflatum* |
| Skeleton weed | *Eriogonum deflexum* |
| Loco weed | *Astragalus spp.* |
| Salt bush | *Atriplex canescens* |
| Mesquite | *Prosopis juliflora* and *P. pubescens* |
| Forget-me-not | *Cryptantha nevadensis* |
| Coyote melon | *Cucurbita spp.* |
| Brittle bush | *Encelia farinosa* |
| Desert sunflower | *Geraea canescens* |
| Paper flower | *Psilostrophe cooperi* |
| Brickellia | *Brickellia arguta* |
| Rabbitbrush | *Chrysothamnus nauseosus* |
| Mormon tea | *Ephedra nevadensis* |
| Prince's plume | *Stanleya pinnata* |
| Desert senna | *Cassia armata* |
| Rice grass | *Oryzopsis hymenoides* |
| Desert holly | *Atriplex hymenelytra* |
| Sand mat | *Euphorbia polycarpa* |
| Salt grass | *Distichlis spicata* |
| Desert 5-spot | *Malvastrum rotundifolium* |
| Ajo desert lily | *Hesperocallis undulata* |
| Cats-claw | *Acacia greggii* |
| Desert spiny herb | *Chorizanthe rigida* |
| Purple aster | *Aster spp.* |
| Desert wash willow | *Chilopsis linearis* |
| Sand verbena | *Abronia villosa* |
| Monkey flower | *Mimulus bigelovii* |
| Cheese bush | *Hymenoclea salsola* |
| Cotton top cactus | *Echinocactus polycephalus* |
| Indian millet | *Plantago major* |

## Ethnozoological Considerations

Large vertebrates used by the aboriginals for food and clothing included deer, antelope and mountain sheep found at the higher elevations during the summer, migrating to lower elevations during the winter. The meat and blood from these animals was eaten, the hides were used for clothing and the bones were split for their nutritional marrow. In many instances bone was also used for tools and ornamentation. Similar to most hunting and gathering societies the aboriginal groups of the Mohave Desert shared the food supplies within the entire group.

Reptiles were hunted by throwing stones or clubs at them. Hooked sticks were employed to pull lizards and other animals from crevices or cracks in the rocks. According to Fowler and Fowler (1971) lizards were captured in great numbers, strung together and allowed to dry. After dehydration the animals were ground into flour and stored. Similarly to other desert cultures, it is considered doubtful that the bones or entrails were removed before preparation. Snakes were utilized in the same way, but to a lesser degree. The desert tortoise was also prized for its food and the quality of its meat. Roasting pits from southern Nevada contain pieces of tortoise shell indicating food preparation practices.

Small mammals including ground squirrels, pack rats, jack rabbits and cottontail rabbits were hunted with hooked sticks, collected in communal drives, or gathered individually with clubs or stones. Snares or deadfalls were often employed to capture smaller animals. Usually, smaller animals were ground in bedrock mortars or metates without removing the bones or entrails.

Various avifauna, including the presently hunted quail and mourning dove, were observed in the study area. Other birds noted were ravens, magpies, sparrows and finches. Many of the hunting techniques used for small mammals were employed for birds. Dawn and dusk were considered as the principle hunting times, when the birds were drinking at springs.

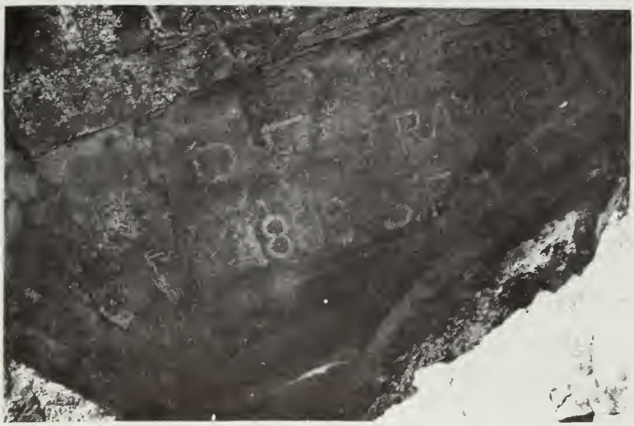
Fowler and Fowler (1971) have described the importance of invertebrates in the aboriginal diet. Grasshoppers, earthworms, larva and grubs were considered delicacies, and actual insect drives utilizing brooms or the pounding of sticks were conducted to collect this valuable food source. It should be observed that invertebrate protein uses twice as much water as carbohydrate foods. For this reason, Noy-Meir (1974) states that, in general, the diet of hunter-gatherers in arid zones is 60-80% vegetarian.

## Summary

Traditionally the protohistoric people of the Mojave Basin-Amargosa Sink have been thought of as little more than savages eeking out a tentative existence in a harsh environment. People have believed that large amounts of time were given to hunting and gathering activities and little effort was spent on art, religion or social organization. Manners (1959, 1974) felt that a low population density and a large territory made tribal and national integration impossible. Apparently an inverse relationship between tribal area and leisure activity compared to rainfall exists. Birdsell (1953) has noted

in desert area in Australia, tribal territories are larger and have more people, even though population density is low. Richard Lee (1976) has demonstrated that the Kung! Bushmen of the Kalahari Desert, and hunting and gathering peoples in general, have much more leisure time than was once expected.

Flexibility, ostracism and other cultural practices were employed to maintain the groups stability. The nomadic bands of the Mojave Desert utilized a multiple resource existence and biotic conservation practices to establish large territories with scattered groups, maintaining a harmonious lifestyle.



Photographs of aboriginal and historic petroglyphs at Cave Springs in the Avawatz Mountains. Photos by Judyth E. Reed, July 1980.

# SECTION 5

# METHODOLOGY

During all three stages of this project the transects selected, both randomly in Stages 1 and 2 and with specificity in Stage 3, for confirmation of the geomorphic strata predictability were more accessible than had been expected. This accessibility is related to several factors: 1) the extensive use of the areas for ORV activities, which has created roads into many previously inaccessible locales; 2) the numerous mining areas within the project transects, with their access roads; 3) several powerlines which criss-cross this section of the California Desert, with their access roads; and 4) the old and new railroad berms with access roads which cut across the project area east to west and north to south. Through utilization of these various means of access the field crews could generally drive the trucks within a half mile of the selected transect with no difficulty. Following the BLM regulations and stipulations trucks were used only on existing vehicular pathways and no cross-country driving was permitted. The five transects located where access roads were unavailable were surveyed by employing a helicopter to reach the transects.

To determine the precise location and orientation of each transect various means were utilized by the individual crews. These methods included triangulation with either a walking or a Brunton compass, pacing from a known area to a corner of the transect, the use of a vehicle odometer, geological landforms and U.S.G.S. section markers. After the transect corner was determined, one crew member walked in 27 paces from this corner, and the other crew member walked an additional 55 paces beyond the first crew member. They then proceeded to walk to the opposite end of the transect, maintaining the same distance from each other throughout the length of the transect. After this was completed, the first crew member walked to join the second crew member, and then proceeded 55 paces beyond him, while the second crew member walked a total of 110 paces from the original line of survey. Then both field crew members returned towards the line from which they started, paralleling each other as they had done on their first walking of that transect. In this manner the crew members were able to walk while visually examining the transect for any cultural manifestations. When anything was observed, the crew member would walk over to inspect a possible historic or prehistoric site situation, so that deviations from the parallel walking procedures occurred.

On the average, each transect would take between one and a half to two hours for the two crew members to walk in this fashion, depending on the terrain and the number of

sites that were being recorded. It was not uncommon for the procedure of walking a transect to take longer than the two hour span. During the walking of each transect, notes were made as to the flora, fauna, and geomorphology of the area. On the completion of each transect, the appropriate BLM records were filled out with regard to transect, site and historic site forms. Historic site forms and site forms were only filled out if a historic or prehistoric site had been encountered during the survey of that transect. Transect forms were filled out by the field crew for each transect surveyed when the transect walking was completed. Each transect was photographed and, if sites were encountered within a transect, then each site was also photographed. All photographs were logged in on a photographic recording form.

The transect forms are entitled the Archaeological Sample Unit Record, and include precise legal location, general location, vegetation, fauna, geology/geomorphology, hydrology, weather conditions, sites if recorded, duration of survey and survey crew members. In addition to a sketch map of the sample unit, a general interpretation and comment section is an integral part of each transect record. Information concerning the entire transect was recorded on this form, more precise data related to any sites encountered were recorded on the site and historic site forms. On these latter forms information as to the environment which was recorded on the transect forms was also repeated on the site and historic forms in a more specific manner. This data, and all observations as to the site encountered within the transect, associated materials, size of site, depth, features, site situation and comments, were placed on these site recording forms.

Various members of the field crew maintained their own field journals during the survey, which they usually wrote up at the end of the field day. In these were noted details that were supplemental to the recording formats, but which could be utilized in preparing the final report at the end of the project.

On the first day of field work the COAR met with the crews in the field near ZZYZX, worked with them closely, and demonstrated how the locations of the transects were to be determined, how to record the data on the transect, site and historic site forms, and the procedures through which each transect was to be surveyed. Each of the survey crew was present at that time and learned these procedures which were followed during the entire field portion of the project.

## Helicopter Use

Through an agreement with the COAR provisions were made in the contract to utilize a helicopter for transects situated in areas which were of difficult access. These transects, five in number, were located in mountainous terrain with no direct access roads. In part, the use of the helicopter was experimental to test the feasibility of this method of transporting field crews to conduct survey in difficult terrain. In addition, during the flights, aerial photographs were taken of the East and West Cronese Lakes and the Mohave Sink.

The method devised for utilizing the helicopter was related to the basis for charges, as there were no costs for time spent on the ground. Flight time was planned so that a maximum number of transects could be covered with the amount of money allotted, which also included the flying time from the North Las Vegas Airport to ZZYZX and return. To accomplish this a two-man crew was flown to the most distant transect and deposited, the pilot having to return empty to pick up a second crew, as the craft only held three people. The second two-man crew was taken to the next transect, after which the pilot returned to pickup the third two-man crew to take them to the next nearest transect to ZZYZX. By this time, the first crew at the most distant transect was finished with their transect and could be picked up and deposited at the fourth transect. This procedure was followed with the second crew, so that the five difficult of access transects were finished.

The five transects surveyed by this procedure were AM-19, T16N, R6E, Section 27, situated in the Avawatz Mountains; MB-516, T12N, R8E, Section 4, situated in the Soda Mountains; AM-243, T15N, R6E, Section 36, situated in the southern end of the Avawatz Mountains; MB-914, T10N, R5E, Section 24, situated in the western half of the Cady Mountains; and MB-971, T10N, R7E, Section 31, situated in the eastern half of the Cady Mountains.

While flying over the East and West Cronese Lakes and the Mojave Sink, previously located and recorded sites were clearly visible. Some of these were sites recorded by Malcolm Rogers, and others were those that had been recorded by the field crew during their survey of transects for this project. The helicopter, despite the expense, proved to be a useful tool in the field and served as an integral part of the field work for this project.

## Private Lands Within the Project Area

A total of 36 transects (listed on page 103), or portions thereof, were located on private lands. The whole

TABLE 1

PRIVATE LANDS

| | Transect | Township | Range | Sec. | Map | Amount of Land |
|---|---|---|---|---|---|---|
| AM | 99 | 16N | 8E | 16 | Baker | All |
| | 201a | 15N | 8E | 16 | Baker | All |
| | 201b | 15N | 8E | 16 | Baker | All |
| | 243 | 15N | 7E | 36 | Red Pass Lake | |
| | 311 | 14N | 8E | 14 | Baker | NE½ Sec. Private ½ trans in private land (Silver Lake bottom) |
| | 564 | 12N | 7E | 17 | Cave Mt. | 1/3 sec. (west trans. not in private lands) |
| | 592 | 12N | 7E | 19 | Cave Mt. | W½ trans. private ½ trans in private land |
| MB | 424 | 13 | 9 | 16 | Soda | All |
| | 631a | 12 | 8 | 27 | Soda | 1/8 of trans. private 1/8 mi long |
| | 660 | 12 | 8 | 33 | Soda | 1/3 private out of private land |
| | 714 | 11 | 7 | 7 | Cave | All |
| | 718 | 11 | 7 | 7 | Soda | 1/8 private |
| | 720 | 11 | 8 | 7 | Soda | ½ sec. private, ½ trans. private |
| | 738 | 11 | 5 | 13 | Cave | All |
| | 744 | 11 | 6 | 13 | Cave | All |
| | 751 | 11 | 8 | 18 | Soda | All |
| | 752a | 11 | 8 | 17 | Soda | 1/8 of sec. private |
| | 759 | 11 | 9 | 16 | Soda | All |
| | 798 | 11 | 6 | 27 | Cave | All |
| | 831 | 11 | 8 | 31 | Broadwell | All |
| | 902 | 10 | 7 | 13 | Broadwell | All |
| | 908 | 10 | 8 | 13 | Broadwell | All |
| | 1028 | 9 | 8 | 9 | Broadwell | All |
| | 1049 | 9 | 7 | 13 | Broadwell | All |
| | 1098 | 9 | 7 | 25 | Broadwell | All |
| | 1112 | 9 | 5 | 36 | Cady | All |
| | 1159 | 8 | 9 | 5 | Broadwell | All |
| | 1170 | 8 | 6 | 9 | Cady | All |
| | 1192 | 8 | 5 | 17 | Cady | All |
| | 1205 | 8 | 6 | 16 | Broadwell | All |
| | 1214 | 8 | 8 | 13 | Broadwell | All |
| | 1396 | 7 | 8 | 21 | Ludlow | All |
| | 1436 | 7 | 8 | 33 | Ludlow | All |
| | 1454 | 6 | 8 | 5 | Ludlow | All |
| | 1470 | 6 | 10 | 1 | Bagdad | All |
| | 1473 | 6 | 8 | 8 | Ludlow | All |
| | 1517 | 6 | 10 | 24 | Bagdad | All |

section was private for 29 of these transects, but for 7 only parts of the transects were located on private land. Eight of the 36 transects were on land parcels assigned to the California State School System. Some of the remainder were railroad owned lands and others were owned by private individuals for use in either ranching or mining. With one exception, no attempt was made to contact land owners, since the areas where the transects were located were completely undeveloped and relatively remote. The one exception was the transect located at Stedman where the modern mining operation is situated, and permission was verbally requested and granted for survey within the area. In no area where individuals encountered who denied access to a transect that was in process of being surveyed. Occasional prospectors or miners were met, but in no instance were these individuals the owners of the land being surveyed.

## Selection of Transects

In the BLM contract the Statement of Work delineates the minimum number of transects to be walked during the survey. The total study area contains approximately one million acres and of this 1%, or about 10,880 acres, was to be surveyed. Each transect was designed by the BLM to be one-eighth mile wide by one mile long, and for the study area at least 136 transects of this size were necessary to total the required acreage to be inventoried. According to the BLM contract, transects were to be selected by a procedure based on a random stratified sampling method. Prior to the initial reconnaissance or field work the project director submitted to the COAR the environmental, or cultural, parameters for the strata selected. The parameters proposed originally were derived from U.S.G.S. topographic maps, but did not concur with those that had been previously utilized in other inventories within the BLM California Desert region. Consequently, after a meeting with the COAR, the proposed strata were modified and the following six geomorphic strata were utilized: Mountain/Hill, Pediment/Arroyo, Playa, Sand Dune, Mojave Sink, and Lava Flow. Position of the transect, north-south or east-west, was chosen randomly in Stages 1 and 2, but in relation to the terrain in Stage 3.

The survey of the transects was divided into three phases: Stage 1, Stage 2, and Stage 3. To obtain a labeling system for the transects, all sections within the project area were numbered sequentially, beginning in the northwest corner of the southern half of the Owlshead/Amargosa Planning Unit and ending in the southeast corner of the Mojave Basin Planning Unit. Those transects within the Owlshead/Amargosa portion of the project area

were given the prefix AM, and those in the Mojave Basin portion the prefix MB. Sites were labeled alphabetically within each transect, as MB-1404, Site A. Unworked single prehistoric flakes were also given a letter designation by some crew members, so that in the Site Description part of the report, the sites discussed within a transect may not follow in alphabetical sequence. This would mean simply that a crew member assigned a letter designation to an unworked prehistoric flake during the field survey of a transect.

A transect was considered within one of the six geomorphic strata if the major portions of that transect occur within the stratum on the basis of an examination of the U.S.G.S. topographic maps. Transects are classified by the assigned stratum in all discussions of the transect distribution. Within any particular transect there may occur more than one of the six geomorphic strata, even though the transect is labeled pediment/arroyo, since the bulk of that transect falls within this stratum it can also contain sand dunes and perhaps playa. When a single site locale is under discussion, or listed in the chart showing the distribution of sites by geomorphological locale, the precise geomorphic stratum in which that site is located is the one specified. Although a site may be in a pediment/arroyo stratum transect, it may also be situated in a dunes locale within that transect, and be designated as a dune site in the site distribution discussion.

In Stage 1 of the survey the transects were selected in a completely random manner, and the six geomorphic strata were imposed on these random transects after the selection processes had been completed. The theoretical concept for the 30% random sampling selection for Stage 1 is explained in detail in Section 6 (page 108). The Stage 2 transects are considered pragmatically random since the selection process was in part derived from the results of the Stage 1 field survey, and in part related to the attempt to insure that the aims of the Desert Planning Staff of obtaining a 1% sample of the area were met (see Section 6, page 115 ff.) for details of the Stage 2 selection process). Where it was observed that some areas had not been sufficiently explored through the Stage 1 selection process (overlaps for Map Key) transects within these sub-areas were selected through reference to the random numbers tables (Rand Corporation 1955), and random numbers were chosen until a transect fell within the sub-area. The distribution of the transects by stratum was still randomly based, although none of the transects chosen for either Stage 1 or Stage 2, also 30% of the total transects to be surveyed, fell within the Dune Geomorphic Stratum. Sites are located in dunes as delineated in the discussion on geomorphic locale (Table 8 and 9).

Only in Stage 3 was the selection of transects nonrandom. Stage 3 transects were placed according to the results of M. Miller's statistical procedures, derived from the predicability of site occurrence within the geomorphic strata during Stages 1 and 2. Forty-two transects were surveyed during Stage 1, 44 transects during Stage 2, and 62 transects in Stage 3, totalling 148 transects walked during the project.

A total of five transects were altered during the course of the field work. The first transect to be altered was Sample Unit AM-391 (Stage 2), located in a terrain with slope inclines up to 75°. On the basis of the ruggedness of this terrain it was decided to change the transect to another transect, Sample Unit AM-392, one mile to the east. The second sample unit that was changed, Sample Unit MB-629, Stage 3, was exchanged for Sample Unit MB-570, about 3 miles to the north-northeast. Unit MB-570 is in an area that had not been surveyed previously, and Stage 3 of the Sample Design was intended to "concentrate on areas expected to yield data based on prior information" (Section 6 page 120). Unit MB-629 was situated close to transects completed during the prior stages, and at this period of the survey, Stage 3, certain areas were felt to need additional transects to insure sufficient sampling data. Another factor concerned the heavy disturbance by ORV vehicles of the terrain of the area where Unit MB-629 is located. Sample Unit AM-1303, Stage 3, located in the Bristol Mountains was changed because of the steepness and ruggedness of the terrain. Sample Unit MB-1534 was substituted as it fulfilled the same areal requirement. The fourth sample unit to be exchanged was Unit MB-1425, Stage 1. Transect MB-1404 was substituted since Unit MB-1425 spans two modern railroad berms that are in process of being extensively altered, resulting in a complete destruction of a major portion of the transect. Transect MB-1404 is about one mile west and one mile north of the original sample unit.

After the process of selecting transects randomly for Stage 1, M. Miller suggested that some alternate transects be randomly selected so that should problems arise during the field survey, and a particular transect could not be walked, there would be available to crews alternative randomly selected transects. This enabled the field crews to utilize their field time most effectively without having to return to contact the statistician. Sample Unit MB-1511, Stage 1, was one of these alternative transects and was listed but never utilized, since there were a sufficient number of transects in each stage to fulfill the probability requirements for the sampling design when Stages 1 and 2 were completed.

Petroglyph from Lava Point in the Mojave Basin Planning Unit.

# SECTION 6

## SAMPLE DESIGN, STAGES 1, 11, AND 111

### OBJECTIVES OF THE STAGE 1 SAMPLE DESIGN

The prime objectives of the Mojave Basin, Owlshead/ Amargosa cultural resources inventory are:

1. to provide a representative sample of the area

2. to intensively survey this sample area

3. based upon data and observation accumulated during this survey, to generate a predictive model of land use (both prehistoric and historic) on which to base further management decisions affecting the cultural resources of the study area.

Because of the small sample afforded (1%) and the large areal population to be covered (1 million acres) the major problem will be in assuring that any sample selected is representative, and therefore valid for making inferences about the population:

> ...precision of results depends on two factors--the inherent variability of the basic units and the size of the investigation. The more homogeneous the basic units, or the larger the size of the investigation, the more precise the results are likely to be (Chakravarti, Laha and Roy 1967:4-5).

One representativeness is established, there should be little trouble in formulating a model based on traditional statistical theory.

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This section was submitted and the author unavailable for making changes, prior to compilation of the whole manuscript. Consequently, when the Dune Geomorphic Stratum was deleted there was no way to alter this particular section. Also, other modifications in the archaeological interpretation of sites or finds that were made subsequent to the completion of this section could not be incorporated into the body of its text or its tables changed appropriately. This section is relevant, however, to the manuscript as a whole, and is included because it describes the theoretical basis for the sampling design for each of the three stages of the project.

In this instance, we have not only a highly heterogeneous study area, but a limited investigation as well. Rather than "putting all our eggs in one basket", a multi-stage sample design was elected. In this way different sample types can be selected and tested in the hopes of arriving at comparable results through different means. Because of the choice of three or more stages a "concensus" can be reached which will aid in illuminating differences between yielded results if concurrence is not attained. In addition, this should also provide a measure of utility for the various sampling designs used in circumstances approximating these.

<u>Stage 1 Sample Design</u>

The Stage 1 sample design provides a base-line for further sampling. The Stage 1 sample is a simple random sample consisting of 42 transects of the projected 136 transects needed to fulfill the 1% goal. Approximately one-third (30%) of the 1% sample will be the simple random sample.

The sample size of 30% was chosen with an aim to gathering enough information on which to base the Stage 11 design, yet leaving an adequate amount for the follow-up studies.

The 30% random sample will provide:

a) Familiarity with the terrain and logistical demands.

b) Information without prior bias on geomorphic and ecological determinants. This information will be analyzed at the end of Stage 1 in order to derive strata for use in Stage 11, as well as give some measure of utility to the stratification of the sample.

Briefly, the sample was implement as follows:

1. The unit for determining the location of a transect was the section. A sample of randomly chosen sections was picked from which transects would be likewise randomly selected. There are two apparent benefits in such a selection:

   a. because of the larger units involved (section vs. 80 acre transect); ease of selection.

   b. possible minimizing of a "random clustering effect". (With a small sample size, even randomly selected units tend to give the appearance of clustering. By using an initial unit equal in size to eight transects, although the sections may tend to cluster, because of the element of size, the transects will not tend to cluster to such a degree).

2. Sections were chosen for inclusion into the planning units on the basis of extent within the planning unit boundaries. Any section with greater than, or equal to, 50% of its area within the planning unit was considered to be wholly within the unit.

3. Sections were arbitrarily numbered North to South and West to East from 1 to N (N being the maximum number of sections - 1504).

4. 42 sections were randomly selected using the Rand Corporation tables (A Million Random Digits with 1,000,000 Normal Deviates, 1955). Selection was made with replacement sections available (in the chosen sections, however, there was no overlay, possibly due to the large pool of possible sections and the small proportion actually chosen).

5. Another set of 42 random numbers, this time from 1 to 16, was chosen to designate the actual transect within the section. Transects 1-8 run North-South, while transects 9-16 run West-East. In this fashion, there is no bias as to the orientation of the transect or its location within the section.

In order to ascertain the geomorphic heterogeneity of the population, each transect upon selection was designated by the geomorphic unit that 50% or more of the transect encompassed. This results in the following distribution:

| | | |
|---|---|---|
| Mountain/Hill | 12 | 29% |
| Pediment/Arroyo | 21 | 50% |
| Playa | 4 | 10% |
| Dune | 1 | 2% |
| Mojave Sink | 3 | 7% |
| Lava | 1 | 2% |

Examination of the maps for the area appear to bear out this distribution as being relatively valid. The potential error is in the smaller units such as Lava or Dune (possibly under-represented or over-represented). Approximately half of the study area appears to be alluvial fan-pediment, while another third is mountainous-hilly.

The Stage 1 sample aids in establishing to what extent geomorphology determines the site presence/absence and type. If geomorphology is not a major determinant, or of minor importance, equal frequencies would be expected regardless of geomorphic type. However, if, as is hypothesized based on previous studies in the Great Basin and elsewhere (i.e. see Davis, Elston, and Townsend 1974; Adams 1972), geomorphology is a distinct and to some extent quantifiable determinant, significant variation among site yields of varying units should obtain. Such being the case, it should

be possible to assign probabilities to the yield of each geomorphic unit.

The purpose of the Stage 1 sample is to assign probabilities to these geomorphic units in terms of site potential. With this data we can then take other samples of varying types and continue to refine and test the validity of sample probabilities in terms of prediction.

Table 2 presents a breakdown of section, transect and geomorphic assignment with sites located (type and additional comment).

Table 3 presents a contingency table of geomorphic units by site types yielded.

Petroglyph from Two Springs in the Owlshead Mountains, as reported by Malcolm Rogers. Illustration by Russell L. Kaldenberg after Rogers' notes for M-74, on file at the San Diego Museum of Man.

Table 2

| SECTION NUMBER | TRANSECT NUMBER | GEOMORPHIC UNIT |
|---|---|---|
| 11 | 2 | V |
| 19 | 15 | M |
| 44 | 5 | V |
| 62 | 5 | V |
| 132 | 2 | V |
| 135 | 1 | V |
| 165 | 15 | P |
| 220 | 7 | V |
| 243 | 1 | M |
| 250 | 16 | V |
| 308 | 11 | M |
| 311 | 5 | P |
| 421 | 2 | P |
| 494 | 15 | P |
| 516 | 9 | M |
| 561 | 16 | M |
| 579 | 1 | V |
| 631A | 7 | MS |
| 637 | 3 | D |
| 693 | 11 | MS |
| 779 | 4 | MS |
| 902 | 13 | V |
| 903 | 14 | V |
| 908 | 10 | V |
| 914 | 2 | M |
| 971 | 11 | M |
| 1028 | 5 | M |
| 1032 | 14 | M |
| 1048 | 12 | V |
| 1112 | 3 | V |
| 1180 | 14 | V |
| 1181 | 7 | V |
| 1205 | 15 | M |
| 1206 | 7 | M |
| 1225 | 5 | L |
| 1296 | 1 | V |
| 1309 | 7 | V |
| 1348 | 8 | V |
| 1350 | 11 | V |
| 1372 | 3 | M |
| 1404 | 16 | V |
| 1517 | 2 | V |

t=42

Table 3

| | M | V | P | D | MS | L | Total |
|---|---|---|---|---|---|---|---|
| HISTORIC | | | | | | | |
| Mining | | 4 | 1 | | | | 5 |
| Railroad | | 2 | 1 | | | | 3 |
| Ranching | | 1 | 1 | | | | 2 |
| Road | | 1 | | | | | 1 |
| Military, etc. | 1 | 2 | | | | | 3 |
| SUBTOTALS | 1 | 10 | 3 | | | | 14 |
| | 7% | 71% | 21% | | | | |
| PREHISTORIC | | | | | | | |
| Lithic | 4 | 6 | 1 | | 1 | 1 | 13 |
| Quarry | 1 | 1 | | | | 1 | 3 |
| Pottery, etc. | | | 2 | | 1 | | 3 |
| Grdstone | | | | | 2 | | 2 |
| Hearth | | | | | 1 | | 1 |
| Isol lithic | | 2 | | | 1 | | 3 |
| Rock rings | | | | | | 1 | 1 |
| SUBTOTALS | 5 | 9 | 3 | | 6 | 3 | 26 |
| | | | | | | | 40 |
| | 19% | 35% | 12% | | 23% | 12% | |

Table 3A

| | Geomorphic | Site | Ratio-Yield |
|---|---|---|---|
| Mountain/Hill | 29% | 15% | .52 |
| Pediment/Arroyo | 50% | 48% | .96 |
| Playa | 10% | 15% | 1.50 |
| Dune | 2% | 0% | 0.00 |
| Mojave Sink | 7% | 15% | 2.14 |
| Lava | 2% | 8% | 4.00 |

Stage 1 Results and Inferences

Table 3A presents the percentage yield results of sites found by Geomorphic Unit (labeled site %), the percentage of area each surveyed geomorphic unit comprised (labeled Geomorphic) and a ratio of yield which was calculated as Site %/Geomorphic %.

On the assumption that there is no preference, or at least significant preference, in favor of one geomorphic unit over another, we would expect relatively equal frequencies (scaled by sample size) in each of the units to obtain. While this assumption is considered invalid by most archaeologists ( substantial portion of the literature is devoted to positive correlation between geomorphology and site location), for this area we have no real estimates of the strength of relation between geomorphology and site presence or absence. The Stage 1 results indicate that not only do geomorphic units serve as a determinant of site location, but also that this degree of determinism can be quantified to some extent.

Mountain/Hill territory amounted to 29% of all the area surveyed, yet these regions only contributed 15% of all the sites, approximately one-half of the amount of sites that would be expected given equal probabilities for all geomorphic units.

Pediment/arroyo comprised 50% of all territory surveyed and accounted for 48% of all sites found. In this case, ratio is approximately .96. Pediment/arroyo yielded the proportion of sites expected to yield.

Playa represented 10% of all area surveyed and accounted for 15% of all sites recovered, giving a yield ration of 1.5 (one and one half times the number of sites that were expected).

Dune accounted for 2% of all land surveyed and 0% of all sites recovered. Dune would be expected to yield approximately 2% of all sites. Stage 1 recovered none in the Dune areas. There are several possible reasons; small sample size (this applies to Lava areas as well, which showed a higher than expected yield by approximately four times). The smaller the sample, the greater the possibility of lack of representativeness. Another possible cause for low recovery in dune areas is the nature of dunesthemselves, covering and uncovering action of constant sand movement.

Mojave Sink areas yielded the highest percentage of sites (other than the small Lava sample); 7% of all surveyed area was Mojave Sink, while 15% of all sites were recovered from this area, a yield of little over two times that expected.

Lava area represented 2% of all area surveyed and 8% of all sites encountered - four times the yield expected. Further research will aim in determining whether this is a true representation, or merely small sample effects.

In summary, it can be seen that there is a distinct preference for certain geomorphic types to others: Playa, Mojave Sink and Lava over Mountain/Hill and Dune (and to a certain extent, Pediment which meets but does not surpass the expected probabilities).

Also of interest are the distributions of prehistoric and historic sites by the respective geomorphic units, (as presented below in Table 4).

TABLE 4

| Unit | Unit % | Hist % | Hist-Ratio | Prehist % | Prehist-Ratio |
|---|---|---|---|---|---|
| M | 29 | 7 | .24 | 19 | .66 |
| V | 50 | 71 | 1.42 | 35 | .70 |
| P | 10 | 21 | .21 | 12 | .12 |
| D | 2 | | | | |
| MS | 7 | | | 23 | 3.29 |
| L | 2 | | | 12 | 6.00 |

Historic Sites - Mountain/Hill and Playa areas each yielded only approximately one-quarter of the expected number of historic sites, while Valley (Alluvial Fan-Pediment) areas yielded almost one and one-half (1.42) times the expected number of sites.

No historic sites were recovered in the dune areas, Mojave Sink area or the Lava areas.

Prehistoric Sites - In the case of Mountain/Hill areas, two-thirds (66%) of the expected number of sites were recovered. Seventy per cent of the expected number were found in Alluvial Fan transects, while the Playa area only yielded 12% (1/8th) of that expected. The Mojave Sink and Lava areas generated the highest percentage of sites per unit, almost three and one third times what would be expected in the Mojave Sink and six times that expected in the lava area. Thirty-five percent of all the prehistoric sites came from only 9% of the surveyed area.

There appears to be a distinct shift between prehistoric and historic preferences. Prehistoric peoples seem to have exploited a wider range of resources than historic peoples. Historic interest is primarily in those areas optimal for mining and railroads (both highly dependent upon each other).

While prehistoric interest was in lithic quarry areas, there was also a heavy dependence upon the availability of free flowing water (without a well technology).

## Stage 11 Sample Design

The stage 11 Sample Design has two goals:

a) to provide a random selection from areas not well covered by the initial 42 Stage 1 transects, and

b) to provide a test of a stratified random sample against the prior probabilities garnered from the Stage 1 simple random sample.

One of the primary aims of the study is to determine the reliability of a 1% sample from such a large and presumably diverse areal population. This is necessary not only for formulating a predictive model as a basis for future investigation, but to furnish a measure of validity for the data accumulated by this survey.

With such an aim in mind, it is essential that the 1% sample encompass the widest possible area (to assure the maximum possible applicability to the entire population). For this reason the Stage 11 sample consists of a random sample of areas not covered by the Stage 1 sample. (Non-coverage was defined as an area approximately two miles square without a Stage 1 transect.) Like the Stage 1 sample, the Stage 11 sample also consists of 42 transects, or approximately 30% of the projected 136 transects to yield a 1% sample overall. These blocks of non-coverage are large enough to insure that a significant area is considered, yet small enough so that they are for the most part relatively homogeneous. Their homogeneity assures that comparisons within each block will be accurate, yet allows for comparison with equal sized units which are characteristically different.

The first stratification made in the selection of Stage 11 transects is between the Northern and Southern halves. There are several reasons for such a preliminary division.

1. Logistically there is a distinct difference between access to sections 1-800 and 801-1504.

2. The two units are equal in size due to section size fluctuation and the inclusion of odd-sized sections, as well as a minor effort made prior to Stage 1 in the assignment of section numbers to sections (duplication of approximately 20 numbers).

3. On a geomorphic basis it is reasonable to draw a division along the section # 800 - line.

4. In a large and/or heterogeneous population, it is advantageous to split the area into smaller units to somewhat alleviate the characteristic sampling fluctuations attendant with such populations.

The second stratification was based upon the units of non-coverage. These units can best be seen as outlined on the population map. Transects were randomly selected from within these units, again using a random number table. Random sections were first selected, and then random transects (enumerated from 1 to 16 as in Stage 1) were chosen. As in Stage 1, geomorphic assignments were made at the time of selection. These geomorphic units will enhance the nature of the data accumulated in the Stage 11 phase and will provide a basis on which to compare and test the Stage 1 results.

The following page summarizes in tabular form the random sections and transects selected and their geomorphic assignments.

Representative petroglyph elements from Kane Wash in the Mojave Basin Planning Unit. Illustration by Russell L. Kaldenberg after Malcolm Rogers' notes for M-49, on file at the San Diego Museum of Man.

TABLE 5

STAGE II - GEOMORPHIC DISTRIBUTION

NORTH PORTION - 22 TRANSECTS

| UNIT | N | %-AGE |
|---|---|---|
| V | 9 | 41 |
| M | 4 | 18 |
| MS | 3 | 14 |
| P | 6 | 27 |
| D | 0 | 0 |
| | 22 | 100% |

SOUTH PORTION - 21 TRANSECTS

| UNIT | N | %-AGE |
|---|---|---|
| M | 7 | 33 |
| V | 12 | 57 |
| L | 2 | 10 |
| | 21 | 100% |

TOTAL STAGE II

| | N | S | T | % |
|---|---|---|---|---|
| M | 4 | 7 | 11 | 26 |
| V | 9 | 12 | 21 | 49 |
| MS | 3 | 0 | 3 | 7 |
| P | 6 | 0 | 6 | 14 |
| D | 0 | 0 | 0 | 0 |
| L | 0 | 2 | 2 | 5 |

TABLE 5A

STAGE II - NORTH PORTION

| SECTION NUMBER | TRANSECT NUMBER | GEOMORPHIC UNIT |
|---|---|---|
| 196 | 7 | V |
| 392 | 11 | P |
| 647 | 3 | V |
| 248 | 15 | V |
| 744 | 2 | V |
| 687 | 11 | MS |
| 576 | 4 | P |
| 804 | 8 | MS |
| 798 | 11 | V (FOSSIL AREA) |
| 384 | 3 | M |
| 24 | 7 | V |
| 751 | 14 | MS |
| 504 | 14 | P |
| 70 | 1 | M |
| 47 | 1 | P |
| 319 | 14 | V |
| 327 | 13 | P |
| 474 | 5 | P |
| 511 | 11 | M |
| 138 | 4 | V |
| 112 | 6 | V |
| 99 | 1 | P |
| 342 | | V |

SOUTH PORTION

| SECTION NUMBER | TRANSECT NUMBER | GEOMORPHIC UNIT |
|---|---|---|
| 1362 | 15 | M |
| 1409 | 9 | M |
| 1504 | 8 | V |
| 1470 | 2 | M |
| 1414 | 2 | M |
| 1214 | 7 | V |
| 1159 | 9 | V |
| 1422 | 7 | M |
| 1478 | 9 | V |
| 1129 | 8 | V |
| 1396 | 15 | M |
| 1136 | 3 | V |
| 1339 | 10 | V |
| 1192 | 3 | L |
| 1251 | 7 | L |
| 1336 | 11 | V |
| 1170 | 5 | V |
| 942 | 3 | M |
| 839 | 11 | V |
| 1354 | 5 | V |
| 986* | 2* | V* |

* This transect was omitted accidentally and is not included in the overall statistics.

Stage ll Design Reviewed

The purpose of the Stage ll sample was twofold:

a) insure representation from areas not well covered by Stage l, and

b) provide a test of simple random sampling (Stage l) against a stratified sample (Stage ll).

TABLE 6

Comparison between Percentage of Geomorphic Units Surveyed in Stage l (Table 4) and Stage ll (Table 5).

| | Stage l | Stage ll | Diff. |
|---|---|---|---|
| Mtn/Hill | 29% | 26% | 3% |
| Pediment/Valley | 50% | 49% | 1% |
| Playa | 10% | 14% | 4% |
| Dune | 2% | 0% | 2% |
| M Sink | 7% | 7% | 0% |
| Lava | 2% | 5% | 3% |

As can be seen, there is very little variance in the percentage distribution of geomorphic units between Stage l and Stage ll (at most 4%). Indication are, therefore, that the originally derived distribution is adequately representative. Variance can, for the most part, be attributed to sample size.

Differences in site distribution across geomorphic units between Stage l and ll (Table 7) are not as easily explained. In Stage ll the yields of Mountain/Hill and Pediment/Arroyo are almost reverse that of Stage l. Stage l yielded three times the expected, and in Stage ll yielded four times. Areas primarily within a lava flow yielded three and one third times as many sites as expected in Stage l, yet only four-fifths as expected in Stage ll.

In spite of the differences in distributions, it is still clear that the Mojave Sink areas (most probably due to available water) and the Lava areas (for raw material quarrying and production) are still highly preferred for prehistoric site locations, although not all utilized in historic times.

When taking into account the differences between Stages l and ll using only prehistoric sites (Table 8), the disparity is lessened somewhat. Mountain/Hill yield is virtually the same; other than Mojave Sink and Lava areas (which represent a small percentage of the overall area), the major differences are between Pediment/Arroyo and Playa. In the Stage l (Pediment) sample, 50% of the area accounted for only 32% of

the sites, while in Stage 11 49% of all the sample (virtually the same as Stage 1 Pediment/Arroyo) accounted for only 12% of the sites. Stage 11 Playa, on the other hand, yielded four times more sites than Stage 1 had.

Although there is not total agreement with the Stage 1 results, the Stage 11 results concur with those of Stage 1 in dicating that geomorphic units do help determine site presence or absence.

## Stage 111 Sample Design

The Stage 111 sample concentrates on areas expected to yield data based on prior information. This information is of two kinds:

a) prior information from Stages 1 and 11

b) information intrinsic to the archaeologist/ investigator. Such information which the investigator has accumulated via coursework, reading and previous investigations in the study area.

In the context of this investigation, areas to receive further study are:

1. hydrologic systems - lakes, rivers and springs
2. areas of high natural raw material yield (outcrops, lava flows)
3. dune areas
4. mountain/hill areas providing prime resources

In specific, the following areas were chosen to receive Stage 111 survey transects:

BROADWELL LAKE
CADY MOUNTAINS
MESQUITE HILLS (South of-)
MOJAVE SINK (Mojave River Wash & Canyon)
DEVIL'S PLAYGROUND
LAVA FLOW AREA (West of Pisgah Crater)
CRONESE LAKES
SODA LAKE
SILURIAN LAKE
SILVER LAKE
BULLION MTS

## Stage 111

The purpose of the Stage 111 survey phase is to examine areas expected to be of interest. These areas of interest were selected on the following basis:

TABLE 7 *

| | STAGE I | | | | | | STAGE II | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N of Sites Hist. | Prehist. | Geomrp Unit% | Yield | Ratio | | N of Sites Hist. | Prehist. | Geomrp Unit% | Yield | Ratio | |
| M# | 1 | 5 | | 6 | | | 3 | 3 | 26 | 6 | | |
| % | 7 | 20 | 29 | 15 | .52 | | 38 | 18 | | 24 | .92 | |
| V | 10 | 8 | | 18 | | | 4 | 2 | | 6 | | |
| | 71 | 32 | 50 | 46 | .92 | | 50 | 12 | 49 | 24 | .49 | |
| P | 3 | 1 | | 4 | | | 1 | 4 | | 5 | | |
| | 21 | 4 | 10 | 10 | 1.00 | | 13 | 24 | 14 | 20 | 1.43 | |
| D | | | 2 | | | | | | | | | |
| MS | | 8 | | 8 | | | | 7 | | 7 | | |
| | | 32 | 7 | 21 | 3.00 | | | 41 | 7 | 28 | 4.00 | |
| L | | 3 | | 3 | | | | 1 | | 1 | | |
| | | 12 | 2.1 | 8 | 3.33 | | | 6 | 5 | 4 | .80 | |
| T | 14 | 25 | | | | 39 sites | 8 | 17 | | | | 25 sites |

* STAGE I and STAGE II - Sites Only

TABLE 8*

| | STAGE I | | | | STAGE II | | | |
|---|---|---|---|---|---|---|---|---|
| | N Sites | Site% | Geom% | Ratio | N Sites | Site% | Geom% | Ratio |
| M | 5 | 20 | 29 | .69 | 3 | 18 | 26 | .69 |
| V | 8 | 32 | 50 | .64 | 2 | 12 | 49 | .24 |
| P | 1 | 4 | 10 | .40 | 4 | 24 | 14 | 1.71 |
| D | | | | | | | | |
| MS | 8 | 32 | 7 | 4.57 | 7 | 41 | 7 | 5.86 |
| L | 3 | 12 | 2 | 6.0 | 1 | 6 | 5 | 1.2 |
| T | 25 | | | | 17 | | | |

*PREHISTORIC SITES ONLY

Table 9

STAGE III

| AREA | SECTION | TRANSECT | GEOMORPHIC |
|---|---|---|---|
| Broadwell Lake | 1152 | 8 | P |
| | 1049 | 7 | V |
| | 1098 | 4 | V |
| Mesquite Hills | 831 | 1 | V |
| (to south) | 835 | 7 | V |
| Cady Mts | 1093 | 10 | V |
| | 870 | 8 | V |
| Mojave Sink | 795 | 7 | Mt |
| Afton Canyon + | 740 | 1 | V |
| N Cady Mts | 737 | 3 | V |
| | 738 | 9 | V |
| | 688 | 6 | MS |
| Mojave River Wash | 684 | 12 | V |
| | 653A | 9 | V |
| | B | 16 | V |
| | 718 | 7 | MS |
| | 720 | 5 | MS |
| | 752A | 9 | MS |
| | B | 10 | MS |
| | 572* | | V* |
| | 600 | 8 | V |
| | 660 | 4 | MS |
| | 787 | 14 | V |
| | 631B | 1 | MS |
| | 632 | 2 | MS |
| Devils Playground | 662 | 1 | MS |
| | 714 | 13 | MS |
| | 697 | 14 | MS |
| | 638 | 16 | MS |
| | 639 | 7 | MS |
| | 759 | 12 | MS |
| | 731 | 5 | MS |
| Lava Flow | 1255 | 1 | L |
| | 1287 | 3 | L |
| | 1249 | 7 | V |
| Alvord Mtn (to east) | 610 | 2 | V |
| Silurian Lake | 9 | 11 | V |
| | 27 | 6 | V |
| | 41 | 15 | Mt (spring to west) |

* This is an alternate transect, never surveyed, which was inadvertently included in the data compiled for Stage III

Table 9

STAGE III (continued)

| AREA | SECTION | TRANSECT | GEOMORPHIC |
|---|---|---|---|
| Soda Lake | 424 | 9 | V |
| | 378 | 3 | V |
| Silver Lake | 201A | 4 | V |
| | B | 7 | V |
| | 278 | 16 | V |
| | 275 | 6 | V |
| | 238 | 14 | V |
| Cronese Lakes | 531 | 14 | P |
| | 507 | 5 | V |
| | 533 | 7 | P |
| | 501 | 1 | V |
| | 564 | 4 | P |
| | 535 | 14 | V |
| | 565 | 8 | V |
| | 621 | 5 | V |
| | 452 | 1 | V |
| | 592 | 16 | V |
| | 505 | 15 | P |
| | 562 | 8 | P |
| | 570 | 9 | V |
| Bullion Mts | 1416 | 1 | V |
| | 1436 | 9 | V |
| | 1454 | 7 | V |
| | 1473 | 6 | V |

a) prior information - Stages l and ll (i.e. Mojave Sink area)

b) information inherent to archaeologist with experience in the area - lake terraces, dune, lava area

c) areas of interest (both geomorphic areas under-represented and areas of archaeological interest) which were under-sampled in the first two stages

Included in these areas of further interest are:

a) hydrologic systems (lakes, rivers, springs)

b) areas of high natural lithic raw material yield (outcrops, lava flows)

c) dune areas (including dune blowouts)

d) mountain/hill areas providing prime resources

This stage represents 43% of the total sample (63 transects) (Stages l and ll comprising approximately 30% each (28 and 29%) with 42 and 43 transects respectively).

The Stage lll survey yielded proportionally more sites:

TABLE 10

| | % of sample | # sites | ratio of yield |
|---|---|---|---|
| STAGE l | 28 | 39 | 1.39 |
| ll | 29 | 25 | .86 |
| lll | 43 | 102 | 2.37 |

There are several possible reasons:

A. A larger sample may tend to yield a proportionately larger number of sites.

B. Simple and stratified random sampling is not the way to locate the most sites, because of greater likelihood that site locations are based on environmental factors rather than being randomly distributed).

C. It should also be emphasized that Stages l and ll samplings were oriented as much toward a determination of where sites were located as well as where they did not occur.

Table 11

STAGE 111 GEOMORPHIC DISTRIBUTION

| | Number of transects | % |
|---|---|---|
| Mtn/Hill | 5 | 8 |
| V-Pediment | 28 | 44 |
| Playa | 3 | 5 |
| Dune | 17 | 27 |
| Mojave Sink | 7 | 11 |
| Lava | 3 | 5 |
| | 63 | |

COMPARISON: GEOMORPHIC DISTRIBUTION - ALL STAGES
(in percentage)

| | I | II | III | Overall |
|---|---|---|---|---|
| Mtn/Hill | 29% | 26% | 8% | 21% |
| V-Pediment | 50 | 49 | 44 | 48 |
| Playa | 10 | 14 | 5 | 10 |
| Dune | 2 | 0 | 27 | 10 |
| Mojave Sink | 7 | 7 | 11 | 8 |
| Lava | 2 | 5 | 5 | 2 |
| Number of transects | 42 | 43 | 63 | |

Table 12

STAGE III - SITE DISTRIBUTION

| | Hist. | Prehist. | Geo% | Yield - total | Ratio |
|---|---|---|---|---|---|
| M | 3 | 5 | | 8 | |
| % | 38 | 63 | 8 | 8 | 1.0 |
| V | 6 | 28 | | 34 | |
| % | 18 | 82 | 44 | 33 | .75 |
| P | 1 | 7 | | 8 | |
| % | 13 | 87 | 5 | 8 | 1.6 |
| D | 7 | 34 | | 41 | |
| % | 17 | 83 | 27 | 40 | 1.48 |
| MS | 1 | 2 | | 3 | |
| % | 33 | 66 | 11 | 3 | .27 |
| L | 0 | 8 | | 8 | |
| % | | 100 | 5 | 8 | 1.6 |

102 total # of sites

Stage 111 - Geomorphic Distribution

The distribution of geomorphic units in Stage 111 is drastically different from the two prior stages (Table 10); less Mountain/Hill, Playa and Pediment/Arroyo were examined while more Dune, Mojave Sink and Lava areas were investigated. In the case of Dune areas only 2% of Stage 1 and none of Stage 11 sample included Dune, whereas 27% of the Stage 111 sample was geomorphically classed as Dune.

This discrepancy in geomorphic units among the stages has several causes. In Stage 1, through simple random sampling, the approximate proportions of each geomorphic unit was achieved; by inspection, about one-half of all areas sampled were composed of pediment. Although close to the Stage 1 distribution, Stage 11 was somewhat skewed by stratification (strata being composed of areas greater than 50 square miles without a Stage 1 transect). Between Stages 1 and 11 the major variation is between the less represented units (Mojave Sink, Lava, etc.), which is reasonable considering the small sample size. In the Stage 111 sample, however, no attempt was made to adequately represent geomorphic units proportionately. In fact, one of the expressed aims of the Stage 111 sample was to insure representation of those areas not well sampled in the first two stages.

## COMPARISON OF HISTORIC vs. PREHISTORIC SITES DISTRIBUTION FOR ALL STAGES

There is a marked difference between the distributions of prehistoric sites and historic sites (Table 12). The prime difference is in the large number of prehistoric vs. historic sites - 126 versus 40, a difference of over three times. The nature of aboriginal life makes this reasonable, especially since most of these prehistoric sites are classed as "temporary camps". Semi-nomadic hunting and gathering necessitated small settlements of short duration over large and time-intensive structures and foundations.

The other main difference is among geomorphic units. Prehistoric sites exhibit a greater diversity in terms of site location. Although Pediment and Dune were the most favored for location, a significant proportion of sites are found spread among the other units; approximately 10% Mountain/Hill, Playa, and Lava; and approximately 14% Mojave Sink. Aboriginal peoples exploited much of the available resources.

Historic settlements, on the other hand, tend to occur primarily (50% of the time) on the pedimental terrain; to a lesser extent in Mountain/Hill (18%), Dune (18%) and Playa (13%) territory; to the virtual exclusion of the Mojave Sink and Lava areas. Only one site was located in the Mojave Sink area, a water tank, and none were located in the Lava flow area.

TABLE 13

OVERALL YIELD - ALL STAGES - historic sites only

| | I | II | III | Overall | Percentages | |
|---|---|---|---|---|---|---|
| M | 1 | 3 | 3 | 7 | 18% | (17.5%) |
| V | 10 | 4 | 6 | 20 | 50% | (50%) |
| P | 3 | 1 | 1 | 5 | 13% | (12.5%) |
| D | | | 7 | 7 | 18% | (17.5%) |
| MS | | | 1 | 1 | 3% | (2.5%) |
| L | | | 0 | 0 | | |
| | | | | 40 sites | | |

One half of all historic sites were located in the Pediment/Arroyo geomorphic units, followed by Mountain/Hill and Dune; considered to be the next most habitable locations for historic sites. It is not surprising that the Lava area accounted for no sites, or that only one was located in the Canyon/Wash terrain of the Mojave Sink.

Table 14

OVERALL YIELD - ALL STAGES - prehistoric sites only

| | I | II | III | Geomorphic Unit Totals | |
|---|---|---|---|---|---|
| M | 5 | 3 | 5 | 13 | 10.3% |
| V(Pediment) | 8 | 2 | 28 | 38 | 30.2% |
| P | 1 | 4 | 7 | 12 | 9.5% |
| D | 0 | 0 | 34 | 34 | 27.0% |
| MS | 8 | 7 | 2 | 17 | 13.5% |
| L | 3 | 1 | 8 | 12 | 9.5% |
| Stage Totals | 25 | 17 | 84 | T. 126 sites | |

In contrast to the historic sites, only approximately 1/3 (30%) of the sites were discovered in the Pediment areas. Another 27% were recovered from the Dune area.

## OVERALL CONCLUSIONS

These results strongly indicate two things:

A. prehistoric and historic sites should be considered separately (Tables 13 and 14);

B. geomorphic units should be considered separately.

Distinctive preferences exist when it is a question of predicting site type and location. Given a Mojave Sink or Lava area the likelihood is almost 9 to 1 (scaling for differential in site yield) that the site will be prehistoric; whereas sites recovered on Pediment could easily be either (with a slight edge toward the site being historic).

The Triangle or Field Road Geoglyph Site located approximately 35 miles east of Barstow, on the north bank of the Mojave River. Photo courtesy of Harry B. Casey, Imperial Valley Museum Society.

# SECTION 7

## SITE PREDICTABILITY BY TRANSECT LOCATION

In reviewing the data collected through the specified procedures of transect survey, the low frequencies of sites in certain of the geomorphic strata during Stages 1 and 2 resulted in the accumulation of negative evidence. The significance of the null data must be clarified as a factor related to the derivation of transect location through the methodology of random stratified sampling. Also, these data must be analyzed as a part of the determination of site density occurrences within the study area. The negative data, or absence of sites within a transect, are indicative of no historic or prehistoric use of that transect area and can be correlated with site frequencies, occupation areas and site density patterns. For the purpose of accomplishing these goals on the basis of transect occurrence within a geomorphic stratum, a method of analysis was devised, and two terms more often associated with human genetic analysis were modified and applied to this archaeological project. Concordance, which in common usage means agreement, is expanded to mean not only agreement, but the numbers of sites or isolate sites within a transect; that is, the density of sites per transect. Discordance, which usually implies disagreement, is also expanded from merely disagreement to refer to those transects in which no sites were encountered.

In Stage 1 concordance of transects for all the geomorphic strata was 55% frequency and discordance was 45%. In Stage 2 concordance of transects for all strata was 32% and discordance 68%. In Stage 3 where the transect location was non-random concordance of transects for all strata was 56% and discordance was 44% (Table 15). These percent frequencies of concordance are derived from the total numbers per stage, and the concordance frequencies are an indication of site densities.

Subsequently, the concept of concordance as used in this archaeological context was further divided to separate transects containing one site only from those containing more than one site or those with isolate sites. It is possible that some of the smaller sites recorded in the field were actually loci of some of the larger sites, but this could only be determined by a more intensive research level survey of these transect areas. Table 15 presents the tabulation of the number of transects, with concordance for each of the five geomorphic strata within each of the three stages. In order to compare transect concordance by geomorphic strata with either historic or prehistoric site occurrences, a similar tabulation was used and is detailed in Tables 16 and 17.

In the tables in Section 6 transects listed as containing isolate prehistoric finds may refer to a single modified flake, or a rock circle with no associated cultural material. In addition, artifacts as an isolated sherd, metate or mano, when originally encountered during the field survey, were considered isolated finds and so recorded by the crew members. The BLM considers discontinuous prehistoric artifacts as prehistoric sites according to their site definitions. These are labeled now as sites on the inventory records and maps, and included as sites in Tables 15 and 16.

Isolated historic debris was not recorded as a site during the field work, although these finds were noted on the transect forms. These single historic finds consisted either of a tin can, a trap or other discarded items found usually in washes, arroyos or in areas where there was evidence of recent human activities and disturbance. Concordance of isolated historic finds in Table 17 has reference only to the occurrence of a claim marker within a transect. Claim markers are included under the isolate sites column in Table 15.

In Table 15 transects with a single site, whether historic or prehistoric, are listed as concordant, and transects with more than one site are tabulated as concordant in the column labeled multiple sites. Transects with a single find, as delineated above, are listed in the column labeled isolate sites. When the site occurrences within transects are divided in Tables 16 and 17 as to historic or prehistoric sites, tabulation of transects with isolate, single or multiple sites changes. If the isolate site, the single site or the multiple sites within a transect are all prehistoric, then Table 17, showing occurrence of historic sites by transect, will indicate discordance for that transect, and the reverse if the isolate, single or multiple sites are historic. Where the multiple sites are divided between historic and prehistoric cultural manifestations, concordance will be appropriately tabulated for both Tables 16 and 17, dependent on the number of historic or prehistoric sites occurring within that transect. In a situation as in Transect MB-564, Site A, where a prehistoric site has been subsequently covered by a historical dump, concordance is tabulated as a transect with a prehistoric site in Table 16 and an historic site in Table 17.

During the tabulation of site occurrence within transects by geomorphic stratum, for each of the three stages percent frequencies of concordance or discordance were calculated. For concordance percentages, these were further divided according to frequencies of single site, multiple site, or isolate site occurrences. Totals of transect percent frequency of concordance are calculated for each of the five geomorphic strata. In addition, for each stage totals for type of site frequencies (single site, multiple

TABLE 15

Historic and Prehistoric Sites

| | CONCORDANCE | | | | | | | | DISCORDANCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage 1 | # trans with isolate sites | % | # trans with 1 site | % | # trans with multiple sites | % | Totals of Concordance | % | # trans with no cultural data | % | Totals | % |
| Mt/Hill | 1 | 20% | 3 | 60% | 1 | 20% | 5 | 42% | 7 | 58% | 12 | 100% |
| Ped/Arroyo | 1 | 9% | 6 | 55% | 4 | 36% | 11 | 50% | 11 | 50% | 22 | 100% |
| Playa | - | | 1 | 50% | 1 | 50% | 2 | 67% | 1 | 33% | 3 | 100% |
| Mojave Sink | - | | 2 | 50% | 2 | 50% | 4 | 100% | 0 | - | 4 | 100% |
| Lava | - | | - | | 1 | 100% | 1 | 100% | 0 | - | 1 | 100% |
| Totals | 2 | 9% | 12 | 52% | 9 | 39% | 23 | 55% | 19 | 45% | 42 | 100% |
| Stage 2 | | | | | | | | | | | | |
| Mt/Hill | 1 | 50% | - | | 1 | 50% | 2 | 22% | 7 | 78% | 9 | 100% |
| Ped/Arroyo | 2 | 25% | 5 | 62% | 1 | 13% | 8 | 30% | 19 | 70% | 27 | 100% |
| Playa | - | | - | | 1 | 100% | 1 | 33% | 2 | 67% | 3 | 100% |
| Mojave Sink | - | | 1 | 50% | 1 | 50% | 2 | 67% | 1 | 33% | 3 | 100% |
| Lava | - | | 1 | 100% | - | | 1 | 50% | 1 | 50% | 2 | 100% |
| Totals | 3 | 21% | 7 | 50% | 4 | 29% | 14 | 32% | 30 | 68% | 44 | 100% |
| Stage 3 | | | | | | | | | | | | |
| Mt/Hill | - | | 1 | 50% | 1 | 50% | 2 | 100% | 0 | | 2 | 100% |
| Ped/Arroyo | - | | 7 | 44% | 9 | 56% | 16 | 43% | 21 | 57% | 37 | 100% |
| Playa | - | | 1 | 17% | 5 | 83% | 6 | 100% | 0 | | 6 | 100% |
| Mojave Sink | - | | 5 | 56% | 4 | 44% | 9 | 60% | 6 | 40% | 15 | 100% |
| Lava | - | | 1 | 50% | 1 | 50% | 2 | 100% | 0 | | 2 | 100% |
| Totals | 0 | | 15 | 43% | 20 | 57% | 35 | 56% | 27 | 44% | 62 | 100% |

TABLE 16

Prehistoric Sites Only

| | CONCORDANCE | | | | | | | | DISCORDANCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage 1 | # trans wi isolate sites | % | # trans wi 1 site | % | # trans wi multiple sites | % | Total of Concordance | % | # trans wi no cultural data | % | Totals | % |
| Mt/Hill | | | 2 | 67% | 1 | 33% | 3 | 25% | 9 | 75% | 12 | 100% |
| Ped/Arroyo | | | 5 | 83% | 1 | 17% | 6 | 27% | 16 | 73% | 22 | 100% |
| Playa | | | 1 | 100% | - | | 1 | 33% | 2 | 67% | 3 | 100% |
| Mojave Sink | | | 2 | 50% | 2 | 50% | 4 | 100% | 0 | | 4 | 100% |
| Lava | | | - | | 1 | 100% | 1 | 100% | 0 | | 1 | 100% |
| Totals | 0 | | 10 | 67% | 5 | 33% | 15 | 36% | 27 | 64% | 42 | 100% |
| Stage 2 | | | | | | | | | | | | |
| Mt/Hill | 1 | 50% | - | | 1 | 50% | 2 | 22% | 7 | 78% | 9 | 100% |
| Ped/Arroyo | 2 | 40% | 2 | 40% | 1 | 20% | 5 | 19% | 22 | 81% | 27 | 100% |
| Playa | - | | - | | 1 | 100% | 1 | 33% | 2 | 67% | 3 | 100% |
| Mojave Sink | - | | 1 | 50% | 1 | 50% | 2 | 67% | 1 | 33% | 3 | 100% |
| Lava | - | | 1 | 100% | - | | 1 | 50% | 1 | 50% | 2 | 100% |
| Totals | 3 | 28% | 4 | 36% | 4 | 36% | 11 | 25% | 33 | 75% | 44 | 100% |
| Stage 3 | | | | | | | | | | | | |
| Mt/Hill | | | 2 | 100% | - | | 2 | 100% | 0 | 0% | 2 | 100% |
| Ped/Arroyo | | | 4 | 40% | 6 | 60% | 10 | 27% | 27 | 73% | 37 | 100% |
| Playa | | | - | | 5 | 100% | 5 | 83% | 1 | 17% | 6 | 100% |
| Mojave Sink | | | 2 | 40% | 3 | 60% | 5 | 33% | 10 | 67% | 15 | 100% |
| Lava | | | 1 | 50% | 1 | 50% | 2 | 100% | 0 | | 2 | 100% |
| Totals | | | 9 | 38% | 15 | 62% | 24 | 39% | 38 | 61% | 62 | 100% |

TABLE 17

Historic Sites Only

| | CONCORDANCE | | | | | | | | DISCORDANCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage 1 | # trans wi claim marker | % | # trans wi 1 site | % | # trans wi multiple sites | % | Totals of Concordance | % | # trans wi no cultural data | % | Totals | % |
| Mt/Hill | 1 | 50.0% | 1 | 50% | - | | 2 | 18% | 9 | 82% | 11 | 100% |
| Ped/Arroyo | 1 | 12.5% | 6 | 75% | 1 | 12.5% | 8 | 35% | 15 | 65% | 23 | 100% |
| Playa | - | | 1 | 50% | 1 | 50.0% | 2 | 67% | 1 | 33% | 3 | 100% |
| Mojave Sink | - | | - | | - | | 0 | | 4 | 100% | 4 | 100% |
| Lava | - | | - | | - | | 0 | | 1 | 100% | 1 | 100% |
| Totals | 2 | 17.0% | 8 | 66% | 2 | 17.0% | 12 | 29% | 30 | 71% | 42 | 100% |
| Stage 2 | | | | | | | | | | | | |
| Mt/Hill | 1 | 100.0% | - | | - | | 1 | 11% | 8 | 89% | 9 | 100% |
| Ped/Arroyo | - | | 3 | 75% | 1 | 25.0% | 4 | 14% | 23 | 86% | 27 | 100% |
| Playa | - | | - | | - | | 0 | | 3 | 100% | 3 | 100% |
| Mojave Sink | - | | - | | - | | 0 | | 3 | 100% | 3 | 100% |
| Lava | - | | - | | - | | 0 | | 1 | 100% | 1 | 100% |
| Totals | 1 | 10.0% | 4 | 80% | 1 | 10.0% | 5 | 12% | 38 | 88% | 44 | 100% |
| Stage 3 | | | | | | | | | | | | |
| Mt/Hill | | | 1 | 100% | - | | 1 | 50% | 1 | 50% | 2 | 100% |
| Ped/Arroyo | | | 5 | 71% | 2 | 29.0% | 7 | 19% | 30 | 81% | 37 | 100% |
| Playa | | | 2 | 67% | 1 | 33.0% | 3 | 50% | 3 | 50% | 6 | 100% |
| Mojave Sink | | | 3 | 75% | 1 | 25.0% | 4 | 27% | 11 | 73% | 15 | 100% |
| Lava | | | - | | - | | - | | 2 | 100% | 2 | 100% |
| Totals | | | 11 | 73% | 4 | 27.0% | 15 | 24% | 47 | 76% | 62 | 100% |

sites or isolate sites per transect) were also tabulated and percent frequency of these concordances calculated, as well as total discordance for that stage. These totals by stage of concordance or discordance are based on the actual numbers, and do not reflect transect distribution by geomorphic stratum. Their importance, in particular, relates to the identification of the percent frequency of concordance of those transects where multiple sites occur that could obscure the disproportionate weight such transects might carry in overall site density calculations. In site density estimates for the project area by geomorphic strata, the confidence level of predictability for a stratum could be skewed by concordance of multiple sites within a few transects located in that stratum. When these multiple site occurrences are averaged to derive site density the presence of numerous transects with no sites in a stratum is thus obscured or ignored.

Transect selection for Stage 1 was through a random sampling procedure as delineated by the COAR. Twenty-eight, or 42 transects, of the total number, 148 transects, were surveyed during this stage. When Stage 1 was completed there were still large areas within the Planning Unit in which no transects had been placed. To insure that random selection of transects were distributed throughout the study area, a pragmatic random sampling procedure was used to determine the locations of the 44 transects for Stage 2 (Section 6, page 115). The selection was pragmatic in that, although transects were chosen randomly, they were included in Stage 2 only if the transect fell within an area where no Stage 1 transects had occurred (Section 6, page 119). These 44 Stage 2 transects totaled over 30% of the total transect number. As a consequence of this procedure, 58% of all the transects in the sampling universe contained transects that had been selected on the basis of a random sampling method (Stages 1 and 2). The 62 Stage 3 transects, or 42% of the total transects, were non-randomly selected and, although still identified as to one of the five geomorphic strata, were located within those strata where site predictability had shown greater frequencies of concordance, indicative of a higher level of confidence (Section 6, page 120). The following four sketch maps outline the position of all the transects (Map 8), and those for Stages 1, 11, and 111.

During the field work for Stage 1, it was observed that the sand dune geomorphic stratum was not a viable entity as a stratum, as no sand dune locales within the project area proved sufficiently large that they equal 50% or more of the size of any one transect, as based on the U.S.G.S. topographic maps. As stated in the section on Methodology, the geomorphic stratum of a transect is determined if 50% or more of the transect falls within that geomorphic stratum. There are numerous sand dunes within the project area, especially in the vicinity of East and West Cronese Lakes

MAP NO. 7

# OWLSHEAD AMARGOSA MOJAVE BASIN

## Transect Locations

**Stages I,II,III**

Owlshead/Amargosa
Planning Unit

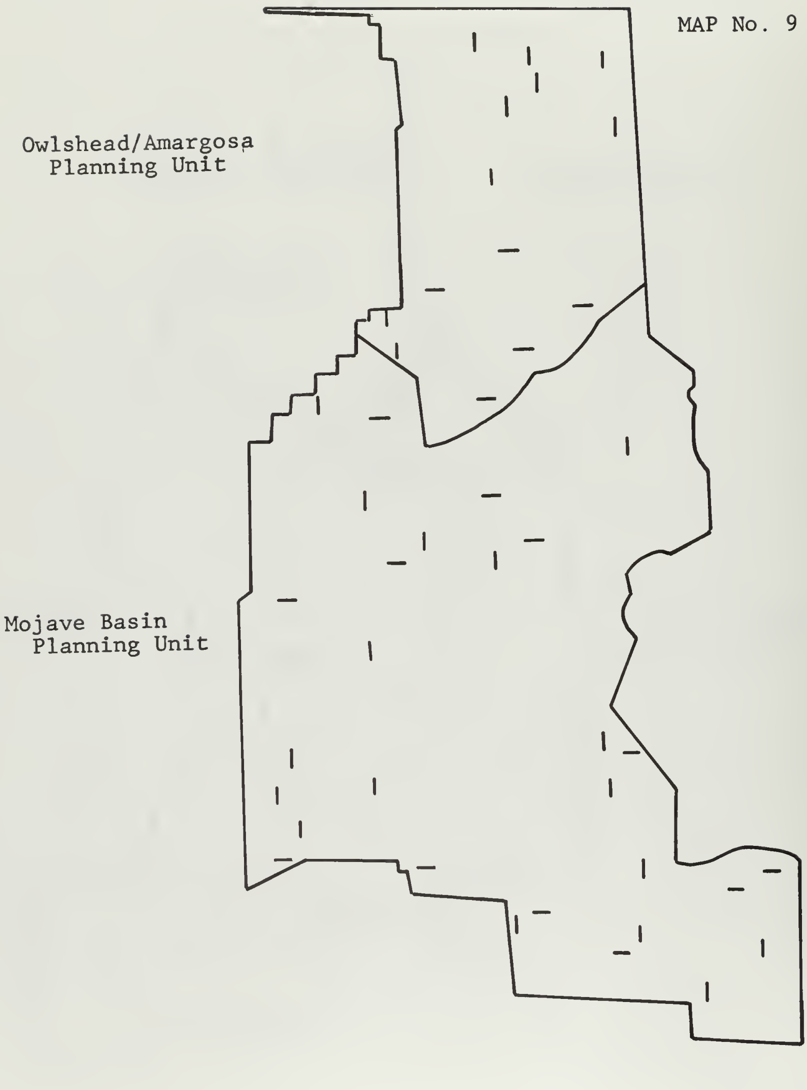
Mojave Basin
Planning unit

MAP NO. 8

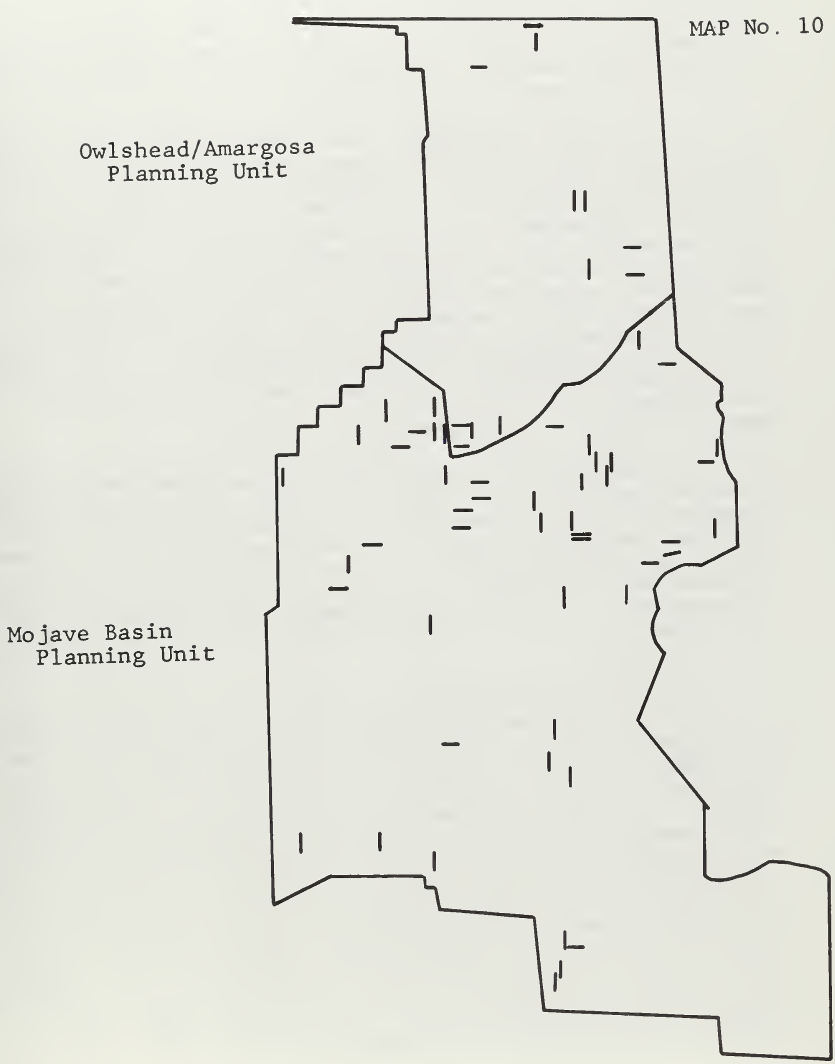
# Stage I

# Stage II

MAP No. 9



# Stage III


MAP No. 10
Owlshead/Amargosa
Planning Unit
Mojave Basin
Planning Unit

and the Mojave River, but they are smaller than 50% of any transect. Only one transect in Stage 1 was listed by Miller as a dune area, but on later consideration was reassigned to the Mojave Sink stratum. Although in Section 6 thirty prehistoric sites are listed as being situated in dunes, this refers to the immediate locale of the site and not to the entire transect designation. Since the majority of the sand dunes actually occur in the Mojave Sink stratum, the dune stratum is effectively merged with the Mojave Sink stratum for the southern Owlshead/Amargosa and Mojave Basin Planning Unit, and not included in Tables 15 through 17 or considered further in this discussion.

In dividing the project into three stages, since there was only a minimum of 136 transects required by the BLM to concur with the 1% level of the sampling with five geomorphic strata within each stage, the total actual numbers for transect concordance or discordance are small. When these numbers are further subdivided into transects with single or multiple sites or isolate sites, as well as historic or prehistoric site occurrences, the number of transects for any specific factor is even smaller. For this reason, percentages were calculated for each factor so that percent frequencies of occurrence could be presented in tabular form (Tables 15, 16 and 17) for comparison of these various environmental and cultural factors and the inferential determination of site density by stratum.

The number of transects for any one geomorphic stratum tends to be related to the proportional distribution of that stratum within the Planning Unit or the sampling universe. The five geomorphic strata are representative of environmental zones and were selected as a classification of the major terrain variations that occur within the project area. Site frequencies are shown as percentages within these strata, since they are a clearer presentation than the raw number data for each stage.

Discordance frequencies of 33% to 81% in the mountain/hill, pediment/arroyo and playa strata occur during Stages 1 and 2, Table 15. In Table 16, where the occurrence of only prehistoric sites in transects is recorded, discordance in both Stages 1 and 2 increases to over 60% for these three strata. In Stage 1 of Table 17, the drop in discordance for the transect occurrence of historic sites in the pediment/arroyo and playa strata, is a reflection of mining activities in the pediment/arroyo stratum and railroad activities in the playa stratum. Discordance of historic site occurrence in Stage 1 transects for the other strata, mountain/hill, Mojave Sink and Lava, is over 80%. For Stage 2 discordance of historic site occurrence for all strata is 86% or more. The confidence level for predicting historic site occurrence through any of the geomorphic strata is not high, as is immediately apparent in reviewing the discordance percentages

in Stage 3 where transects were non-randomly selected. Only the mountain/hill and playa strata show any degree of concordance. The 50% mountain/hill historic concordance relates to mining activities, while the 50% concordance in the playa stratum reflects railroad oriented sites.

In Stage 3 discordance for the occurrence of all site types has a frequency of under 50% for the five strata. When selecting the non-random locations for the Stage 3 transects data feedback from the field work for Stages 1 and 2 determined the positioning of the transects in geomorphic strata (Section 6, page 125). Discordance percentages are under 50% for the occurrence of all site types within the strata, the frequency of 57% for pediment/arroyo being the highest discordance for a stratum in Stage 3 (Table 15). When prehistoric site occurrence only within Stage 3 transects is considered, the overall comparison of discordance/concordance is 27% to 73% (Table 16). The concordance is high for mountain/hill, and relates to the dependence of aboriginal use on this environmental zone for quarrying activities. Even in Stage 3, where transects were non-randomly selected, the discordance percentages are not extremely low, with the exception of mountain/hill and playa, which is a factor of the number of transects in which no cultural manifestations were observed, or null data.

As mentioned earlier, the occurrence of multiple sites within one transect, if not segregated as a specific factor, can disproportionately weight site frequency analysis and attempted site density prediction. Since the clustering of historic sites frequently has relevance to a particular economic activity source or to railroad berms, prehistoric sites only are included in this consideration of site density. During Stage 1 and 2 no more than nine transects for each of the five geomorphic strata contained multiple prehistoric sites (Table 16). The one Stage 1 transect with multiple sites in the pediment/arroyo stratum has a low frequency, 17%, relative to the total number of transects with concordance in Stage 1. Those transects with multiple sites in the Mojave Sink stratum have a frequency of 50% of the total number of Stage 1 transects with concordance. The four Stage 2 transects with multiple prehistoric sites occur one each in the mountain/hill, pediment/arroyo, playa and Mojave Sink strata with a frequency of 36% of the total number of transects with concordance. During Stage 3, transects with multiple prehistoric sites increase to six within the pediment/arroyo stratum, or 60% of the total concordance; and five in the playa stratum, or 100%; three in the Mojave Sink, a frequency of 60% of the total concordance; and one transect with multiple sites, or 50% frequency, in the lava stratum. These multiple site transect concordances are an indication of increased aboriginal use of these environments prehistorically within certain locales. In the environmental discussion of the

frequencies of site distribution, independent of transect geomorphic stratum determination, there is a clear indication of the correlation of prehistoric sites within locales whose biotic resources were known to be exploited ethnographically.

An aspect of this 1% survey of the project area is the expectation that some reliability can be placed on data derived from this percent frequency of observation for establishing site prediction within a designated region. Percent frequencies of concordance in transects located within four of the five geomorphic strata give some measure of the confidence level for site prediction that has resulted from this project. The frequency of occurrence of isolate, single and multiple sites per transect are an indication of the density of sites within this 1% of the acreage of the Planning Unit. A better reflection of density is the type of geomorphic locale (not the geomorphic stratum of the transect) in which the site is situated. In Tables 18 and 19, which list site frequency by the geomorphic locales of the site, high frequencies of site percentages occur within the sand dune locale and the Mojave Sink locale areas. The pediment geomorphic locale also has high site frequencies which is interpreted as the aboriginal exploitation of the float materials available for quarrying and manufacture of lithic artifacts.

In a retrospective review of the sampling design (Section 6) and the delineation of the project transects into three stages, it is now believed that a two stage sampling design might have proved simpler. Also, in consideration of the purpose for which Stage 2 was used, that of insuring transects positioned throughout the Planning Unit, a larger Stage 1 with perhaps 60 transects would have effectively provided this distribution. It is suggested, based on the results and analysis of field research, that an initial stage containing about 40% of the transects should have been established through a random stratified sampling procedure. It is interesting that in Stage 2 the randomly selected 44 transects show a significantly lower total concordance, 32%, than the Stage 1 transects, 55%. In fact, when total transects for these two randomly selected stages are combined concordance is 43% and discordance is 57%. Random selection of transects provides clues as to site patterning, but essentially there is less than a 50% chance that sites will occur within a randomly selected transect for this project area when based on a 1% sample. Field reconnaissance, prior to devising the parameters of the geomorphic strata is advised, since in this project area the information obtained would have led to the merging of sand dune stratum with that of the Mojave Sink with regard to transect stratum designation only. Sand dune locales, from the site frequencies calculated for this project, were valuable prehistoric resources.

The procedure of random sampling, utilizing imposed geomorphic strata for the initial stage of this project, was productive in demonstrating what areas and resources were exploited prehistorically, as compared with the historic use patterns. Subsequent to the completion of the first stage, the second stage should have included the remaining 60% of the transects, which would have then been located within those geomorphic strata showing higher transect concordance to either confirm the concordance or indicate discordance with the additional data base. The helicopter could have been used as part of the first stage, at the end, and just prior to beginning the second stage. In this way accessibly difficult transects could be reached and simultaneously aerial overviews could be used for determining transect locations for the second and non-random stage of the project.

The inclusion of null data through the use of the concept of concordance and discordance has proven a useful tool in the interpretation of the data resultant from the field survey. Negative information is a significant factor in any attempt to predict site frequencies, densities or confidence levels for a project area in which the transects cover little more than 1% of the actual acreage. Discordance clarifies the use of percent frequencies of occurrence where high frequencies appear, but are derived from a small actual amount of data. A 100% concordance for a transect in a geomorphic stratum may merely be the reflection of one transect for that stratum in a particular stage, and not of predictive value nor an indication of site density.

One of the problems of transect concordance/discordance for geomorphic strata relates to the statement of Morrison (1965) that in the southern Great Basin the pediment valleys are wider. This statement offers an explanation of the differences observed between the transect geomorphic strata lower concordance frequencies and the site geomorphic locale higher frequencies. In the wider valleys of the southern Great Basin, one transect a mile long may span several of the five geomorphic strata delineations, but be given the designation of that geomorphic stratum which occupies 50% or more of the total transect. Since nearly 30% of the transects contain multiple strata, transect designation by geomorphic stratum tends to incorporate too many environmental variables in the wider valleys of the southern portion of the Great Basin in which the project area is located. This factor is effectively seen in the lower transect frequencies of concordance within geomorphic strata.

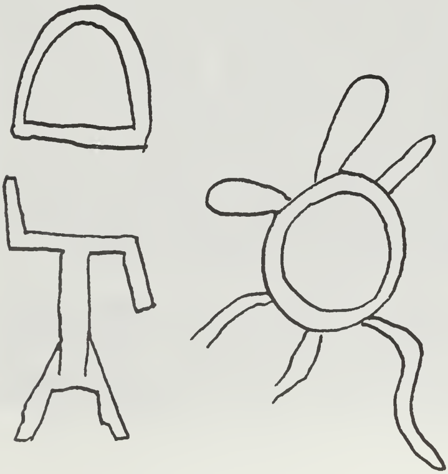
To draw final conclusions from transect concordance alone would prove unreliable as to the actual prediction of site densities for any specific environmental locale. For that information, it is necessary to consult the precise environs of the site itself, using the six geomorphic strata delineated for the transects, but with reference to the

specific geomorphic locale where the site is situated. The results of this analysis shown in Tables 18 and 19 are utilizable in site prediction by geomorphic locale, and in the determination of confidence levels with regard to this distribution as well as the site densities of site types within the Planning Unit.

In the consideration of site distribution within this project area there are factors which affect any interpretation of these sites, or the artifactual patterns within them. Historically this area has been researched by archaeologists over time, so that there is recorded data about sites, their artifactual associations and their features, particularly in the Cronese Lake and Mojave Sink areas.

Since the time when archaeologists began recording sites in the project area during the 1920s and 1930s, and the time of field observations of these same sites by the crew members for this project, there has been destruction and disturbance through erosional and climatic conditions, as well as an accelerated human impact on archaeological sites through the heavy use of the area as a center for recreational activities. On several occasion when field crew were surveying during weekends or holidays, particularly in the Mojave Sink area, groups of 20 to 30 recreational vehicles towing dune or dirt bikes were observed. This is indicative of the ongoing type of impact that has been occurring, particularly in dune locales in the Mojave Sink area within the past ten years.

During the project no transects directly involved the historic Mojave Trail or the Old Government road, which passes through the Planning Unit in parts of Soda Lake, Mojave Sink and the Afton Canyon of the Mohave River. The trail is discussed in the Historic section by Roske, and has been fully described by Dennis Casebier (1975).



Petroglyphs from Rock Corral as noted by Malcolm Rogers. Illustration by R. Kaldenberg, after Rogers' notes from M-133, on file at the San Diego Museum of Man.

# SECTION 8

# ARCHAEOLOGICAL SITE INTERPRETATION

## Background

As in many other areas of the Mohave Desert, within the project area the first archaeological work of any substance was carried out by Malcolm Rogers during the 1920s. Rogers, working under the auspices of the San Diego Museum of Man, began intensive research and made extensive collections from the study area and the adjacent regions. This earlier work was followed in the 1930s by widespread research in the Lake Mohave area by E. and W. Campbell, who published through the Southwest Museum, Los Angeles. In a number of these projects they were aided by Charles Amsden of the Southwest Museum. This early work has been followed more recently by the research of Ruth D. Simpson in the Manix Lake area; T. Orr and C. Warren; Warren, DeCosta, Brainard, and others who have worked in both the Silver Lake and Soda Lake area. W. Venner and J. Benton have recently excavated a small shelter site north of Baker in the Silver Lake area.

To date, many authors feel that "what are probably the earliest remains of human activity in the California desert are, at present, not adequately dated or described. It is not known what plants and animals lived in the vicinity of the sites, nor is it understood how artifacts found at the sites were used" (King et al. 1967:21). Hester (1973) has remarked that,

> So many cultural-chronological sequences have been proposed for the Mohave Desert that it is difficult to know just where to begin to sort them out. There are a number of claims of extreme antiquity for man's presence in the Mohave region. Simpson...proposed a Manix Lake Lithic Industry which she placed in excess of 20,000 years of age. However, more recent finds by Simpson (in association with L. S. B. Leakey) have been made in the Calico Hills area. Although there have been claims that these finds date back more than 100,000 years..., most archaeologists remain unconvinced that the lithic materials found at the site are indeed the result of human manufacture (Hester 1973:73).

Prior to Warren and Crabtree's recent (in press) description of their southwestern Great Basin data, a number of different chronologies have been utilized. Donnan (1964) described the sequence as Tule Springs, Lake Mohave-Playa, Pinto Basin, Amargosa, Non-Yuman, Yuman and

Shoshonean; Hester (1973) as San Dieguito, Pinto, Amargosa and Yuma-Shoshonean; and T. King (1976) as Pre-Projectile San Dieguito, Pinto, Amargosa, Yuman-Shoshonean.

Pre-Projectile Point Stage. The dating and validity of this stage has been debated for several years entirely on the basis of sites which contain crude choppers, scrapers, cores, and other lithic implements. In the Mohave Desert region R. D. Simpson has assigned a date of 15,400-16,000 B.C. for her Manix Lake lithic assemblages (T. King 1976). While this stage may be possible for the region, the unequivocal evidence for such a stage has yet to be presented and accepted by both regional specialists and archaeologists at large. Donnan's (1964) proposed Tule Springs Stage appears to be subsequent to the last of this Pre-Projectile Stage.

San Dieguito Complex. This stage is the earliest archaeological sequence to be accepted for the Mohave Desert region and was described by C. N. Warren (1967) as a "generalized hunting tradition". Artifact assemblages for the San Dieguito complex include crescents, ovate points, planes, borers, thin biface knives, end and side scrapers, choppers, cobble hearths, lanceolate bifaces and Lake Mohave and Silver Lake points (T. King 1976). San Dieguito sites usually occur near playa edges and may have been occupied during the time of relatively greater effective moisture.

In 1937 the Campbells proposed an industry known as the Lake Mohave Industry, which is derived from sites which are located on old beaches and terraces of the Pleistocene Lake Mohave. Rogers (1939) established a Playa Industry based on sites located in the Mohave and Colorado Deserts of California and a portion of western Arizona. Both of these industries are based primarily on a hunting subsistence pattern. They resemble each other, and also the San Dieguito Complex from San Diego County, California. Warren and True (1961:271) stated that:

> Considering the data now available there appears to be strong evidence that the Playa Industry described by Rogers (1939), the Lake Mohave Complex (Campbell et al, 1937) and the San Dieguito Complex are roughly contemporaneous and share many traits which set them off as an early cultural horizon extending across Southern California.

Warren (1967) and Hester (1973) suggest that the complex had a terminal date of 6,000 to 7,000 B.C. Woodward and Woodward (1966) state that according to their geological dates in the Lake Mohave study area some of the sites may extend to 4,500 B.C.

Pinto Basin Complex. It has been suggested that, in the Mohave Desert, the Pinto Basin Complex follows that of the San Dieguito Complex. This stage is delineated by surface camps, which usually contain lanceolate points with weak shoulders, and short stems in various forms (Clewlow 1968). Also contained in the sites are metates, manos, choppers, scrapers and numerous other lithics.

The subsistence pattern of this complex still appears to be heavily weighted toward hunting, but with the increased exploitation of seeds and plants. The number of hunting tools, in comparison with the number of plant processing tools found in the sites, tend to support this proposal.

This complex is thought to have begun between 6,000 and 7,000 B.C. according to Antevs (1952), but there are conflicting dates suggested by other authors. These other proposed dates tend to average a time period for the beginning of this site complex at around 3,000 B.C. and a continuation to between 500 B.C. to A.D. 0. Hester and Heizer (1973) also suggest that in the Mohave Desert some of the more recent components, as Silver Lake Points, may bridge the time between San Dieguito and Pinto Basin Complexes.

Amargosa Complex. As Hester points out, this complex is so little known that its chronological boundaries are unclear. First defined by Rogers in 1935, he divided the Amargosa Complex into two phases; one characterized by large corner and side notched points and the other by a decrease in the size of the point types. Wallace (1962) has suggested that the second phase is better defined archaeologically, and has linked it with Anasazi occupations in the Mohave Desert when these people exploited turquoise deposits there. A temporal span from A.D. 0 to A.D. 500 has been proposed by Rogers and others for this complex, but Lanning (1963) equates the Amargosa Complex with the Middle Rose Springs sequence of ca. 500 B.C. to A.D. 500.

Yuman-Shoshonean Complex. The Amargosa complex is followed by the Yuman-Shoshonean complex, which has probably late prehistoric and historic sequences occurring in the Mohave Desert. The Yuman phase initially was characterized by small points, an extensive ground stone industry and the absence of ceramics (T. King 1976). Dates of this complex vary, depending on the part of the Mohave Desert in which sites are found. In the Providence Mountain area a date of A.D. 800 to A.D. 1400 is related to the Yuman phase. "Donnan (1964) has proposed a more complex cultural sequence of a Non-Ceramic Yuman Horizon ending ca. A.D. 700, a Yuman Horizon characterized by various ceramics from A.D. 800 to A.D. 1400, a Shoshonean

Horizon of intrusive Southern Paiute peoples from A.D. 1400 to A.D. 1850, and a protohistoric Desert Mohave Indian occupation from ca. A.D. 1790-1815" (T. King 1976:133). In his summary of the various views on the overall complex, King (1976) follows Donnan's sequence of phases with a modification of the Mohave Indian occupation. The proto-Historic phase King suggests is "locally characterized by Serrano and Vanyume occupations from ca. A.D. 1776 to A.D. 1900" (1976:135-136).

In a recent revision of the chronological sequences of the southwestern Great Basin, Warren and Crabtree (in press) have proposed five periods. The suggested chronological sequence is based on a broad range of site analysis and sequences within the southwestern Great Basin area, whereas many of the other chronologies are based more on the Mojave Desert region of southern California.

Period I, Lake Mojave, is the earliest and is further divided into three complexes. Complex A consists of fluted points which at this time are not fully documented, as they are isolated surface finds with no other archaeological association. Complex B is the San Dieguito, which has been dated from before 7,000 B.C. to about 6,000 B.C., and includes leafshaped points, knives, crescents and various domed scrapers. "This assemblage exhibits a relatively crude stone flaking technology producing irregular edges, deep bulbs of percussion and step fractures, irregular surfaces, and flat, crushed edge surface as if supported on an anvil" (Warren and Crabtree, m.s.:8). Complex C is the Haskomat Complex, which is found primarily in the northwestern Great Basin, but appears to contain lithic shapes, some of which are similar to those found in the San Dieguito Complex. In the north, the Haskomat Complex has been dated from about 8,000 to 5,000 B.C. Warren and Crabtree (in press) suggest that Period I complexes represent a hunting technology and may have been adapted to a lakeside environment. There is an apparent complete lack of seed grinding implements.

Period II is designated as Pinto and has been dated from about 5,000 to 2,000 B.C. The artifact assemblage is similar to that already described for Pinto Basin, but Warren and Crabtree (in press) mention the use of seed grinding equipment during this period, although they feel it never played as significant a role as in other desert cultures.

Period III is called Gypsum and is dated from about 2,000 B.C. to A.D. 500. The most frequently encountered projectile point types are Elko eared, Elko corner notched, Gypsum Cave and Humboldt concave base. Associated with these are some metates and manos, knives, scrapers, drills and shell and stone beads. "More diagnostic traits

include the introduction of incised and painted pebbles and slate tablets, and the presence of split-twig figurines and petroglyphs of animals in associations that suggest well developed hunting ritual" (Warren and Crabtree, m.s. :18).

Period IV, Saratoga Springs, is dated from about A.D. 500 to A.D. 1,000. Projectile point sizes are reduced and are represented by Rose Springs side notched, Rose Springs corner notched, Rose Springs contracting stem, and Cottonwood triangular points associated with grinding tools, incised stones and slate pendants.

Period V is called Shoshonean and is dated from about A.D. 1,000 to the time of historic contact. Desert side notched projectile points are well represented, as are triangular knives, mescal knives, incised stones, plain sherdwares, and numerous unshaped manos and metates. "The characteristic assemblage for Period V apparently represents the development and dispersion of Shoshonean peoples across the Mohave" (Warren and Crabtree, m.s.:23).

## Results of Site Type Analysis

Within this section the discussion is concerned only with the analysis of historic and prehistoric site types (not the isolate prehistoric sites), that were encountered within transects, as these relate to the geomorphic locale. The site geomorphic locale is the immediate environment in which a site is situated within the transect, while a geomorphic stratum refers to the geomorphic designation of the entire transect. Transects are classified within a geomorphic stratum if 50% or more of the transect falls within that geomorphic designation. The six geomorphic designations were determined by the COAR, and include mountain/hill, pediment/arroyo, dunes, Mojave Sink, lava, and playa. As was explained in the consideration of site occurrence frequencies by transect, the southern Great Basin pediment valleys are wide, and several different environmental locales can occur within a one mile long transect. Consequently, in analyzing actual site frequencies, geomorphic locales are more precise specifications for deriving some estimate of potential site prediction or site densities for the project area.

Types of sites encountered in the survey are grouped as mining activity, trash dumps, ranching, historic rock circles, historic camps and towns, water tanks, railroad, mixed historic and prehistoric materials, prehistoric lithics, prehistoric temporary camps, milling stations, pottery locus, and rock circle (prehistoric). Table 18 demonstrates the distribution frequencies of these site types within the six designated geomorphic locales by stage.

TABLE 18

SITE VS GEOMORPHOLOGICAL LOCALE

| | Mountain & Hill | | | Pediment | | | Dunes | | | Mojave Sink | | | Lava | | | Playa | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| Mining Activity | 4 | 1 | 5 | 1 | | 1 | | | | | | | | | | 1 | | | 13 |
| Trash Dumps | | | | 1 | 2 | 1 | | | | | 1 | 1 | | | | | | | 6 |
| Ranching | | | | 1 | | | | | 1 | | | | | | | | | | 2 |
| Rock Circles (Historic) | | | | 2 | | | | | | | | | | | | | | | 2 |
| Camps & Towns | 1 | | 1 | 1 | | 2 | | | | | | 2 | | | | | | | 7 |
| Water Tanks | | | | | | 1 | | | | | | | | | | | | | 1 |
| Railroad | | | | 1 | | | | | | | | 1 | | | | 1 | | 1 | 4 |
| Mixed Historic & Prehistoric | | | | 1 | | | | | 1 | | | | | | | | | | 2 |
| Lithic Material | 6 | 2 | 1 | 10 | 3 | 13 | | | 1 | 1 | 6 | 6 | | 1 | 3 | | | | 53 |
| Temporary Camps | | | 1 | | 1 | 2 | | 2 | 27 | 5 | 2 | 6 | | | | | | | 46 |
| Milling Station | | | | | | | | | 2 | 2 | | | | | | | | | 4 |
| Pottery Locus | | | | | | | | | 1 | 1 | | 3 | | | | | | | 5 |
| Rock Circle | | | | | | | | | | | | | | | | | | | 0 |
| Isolate | | 1 | | 2 | 2 | | | | | | | 1 | | | | | | | 6 |
| Total | 11 | 4 | 8 | 20 | 8 | 20 | 0 | 2 | 33 | 9 | 9 | 20 | 0 | 1 | 3 | 2 | 0 | 1 | 151 |

Mining Activity. This site type includes mine shafts, prospect holes, mining cairns, loading chutes, and processing mills. Mining activity excludes mining camps and towns, since they are designated within a separate category as historic camps and towns. A total of 13 separate sites within the mining activity designation was located, of which 10 were in the mountain/hill locale, 2 within the pediment/arroyo locale and 1 in a playa locale. Table 18 shows the breakdown of this site type by locale and stage. The ten mining activity sites in the mountain/hill locale consist of those activities related to the distribution of the ore being mined, while the two sites located within the pediment/arroyo locale are the remains of processing mills, which were situated at a lower level. The site in the playa locale is a mining dump.

Trash Dumps. This site type includes all discarded historical materials which are in an isolated context and not associated with any other site type. Four trash dumps were encountered within the pediment/arroyo locale, and two within the Mojave Sink locale. Table 18 shows the distribution of these sites by stage and locale. The reasons for positions of the isolated historic trash dump sites cannot be determined. Both the railroad record file dump and the fresnos (earth scoops) were apparently abandoned impractically. The field dump is near an old siding at the apex of Afton Canyon and the Mojave Sink, and contains records within the filing cabinets from depots throughout the west and as far east as Kansas City. The worn out fresnos were hauled nearly one-half mile from the railroad bed, where they had been utilized during construction instead of leaving them in a locale adjacent to the railroad.

Ranching. This type of site includes locales that were potentially the remains of historically abandoned ranching activities, which include buildings with associated possible animal enclosures and historic camps around wells. Only two sites of this type were located; one found during Stage 1 is in the pediment/arroyo locale, and the one in the dune locale was found during Stage 3. The former site contains historic living debris surrounding a well area, and the latter site contains remnants of historic buildings, possible enclosures and a fence.

Historic Rock Circles. These are circular enclosures of rocks, usually only one rock high, associated with historic debris. Only sites of this type were encountered both in Stage 1 located within the pediment/arroyo locale. The sites contain rock outline circles, one with associated historical debris and the other near tank tracks. It is assumed that these may have been made during army maneuvers in World War II.

Historic Camps and Towns. These sites include historic buildings, trash dumps, roads, tent outlines, and other evidences of non-ranching activities. These are considered to be semi-permanently or permanently utilized areas. Two historic camps or towns were located in the mountain/hill locale, three were encountered in the pediment/arroyo locale, and two in the Mojave Sink locale. Table 18 shows the distribution of these sites by stage and locale. One town is the historic Ragtown, located in the pediment/arroyo locale, which was utilized by miners who worked in the surrounding areas. The other sites are camps that are located on or near mining activity areas, with one exception. This is a camp situated in the middle of Silver Lake and has an ore dump near it, so it also is probably related to a mining activity. The largest camp recorded is probably Rochester, discussed by Roske in the Historic section, and is located within a pediment/arroyo locale, south of Ragtown and north of Stedman.

Water Tanks. The only water tank encountered is in the Mojave Wash, located within the pediment/arroyo locale during Stage 3. The tank had no associated historic materials and may have been placed there for cattle usage.

Railroad. All the sites included in this designation are railroad berms of the historic Tonopah & Tidewater Railroad, which crossed four separate transects. Despite the fact that each of these recordings of a railroad berm is part of the same railroad, they were separately noted as individual sites, as directed by the COAR. One site where the berm crosses was in the pediment/arroyo locale, one in the Mojave Sink locale, and two in the playa locale. Table 18 shows the distribution of these berms by stage and locale. The Tonopah & Tidewater Railroad within the project area extends from Stedman in the south, northward through Silver Lake, east of Silurian Lake and ends well outside the Planning Unit in Tonopah, Nevada.

Mixed Historic and Prehistoric. These sites are situations where either historic sites were situated on top of previously existing prehistoric sites, or those cultural manifestations where the site had no associated identifiable materials. One of these types of sites occurs in the pediment/arroyo locale found in Stage 1, and one in the dunes locale found in Stage 3. The site located within the pediment/arroyo locale is a rock circle with no cultural material around it, so no determination could be made as to historic or prehistoric site type. The site within the dunes locale consists of a prehistoric temporary camp covered by a historic trash dump.

Lithic Material. This site designation does not include any of the isolate sites that are cited in Tables 15 and 16, but refers to prehistoric sites where the cultural data was

entirely composed of lithic materials. This site type includes lithic scatter sites without adjacent quarryable materials, lithic sites that contain some type of float material that could be utilized for tool manufacture, and exposed chert outcrop with associated flakes. Nine lithic sites were encountered in the mountain/hill locale, 26 within the pediment/arroyo locale, 1 within the dunes locale, 13 within the Mojave Sink locale and 4 within the lava locale. Table 18 shows the distribution of these sites by stage and locale. Of the nine sites in the mountain/hill locale, one is the exposed chert outcropping, or vein, with associated flakes, the other eight are lithic scatters with no quarryable material. The pediment/arroyo locale contains both sites with quarry float material and associated flakes, as well as lithic scatter sites. The single site in the dunes locale is a lithic scatter, as are the thirteen sites within the Mojave Sink locale. The sites in the lava locale consist of two lithic scatters and two sites with float material and associated cores and flakes.

The predominant frequency of lithic material sites in the pediment/arroyo locale, and the smaller frequency in the mountain/hill locale, appear to be directly related to prevalence of washed out quarry materials in these areas in the form of float, mainly various cherts. No diagnostic artifacts were identified among these lithic material sites in any of the locales, and the number of actual workshop areas associated with these sites is limited. The workshops usually contain several cores and waste flakes, but almost no recognizable hammerstones. The lithic sites found in the dunes and the Mojave Sink locales appear to be secondary work areas where roughed out materials were being further refined. The few sites in the lava locale are both primary and secondary work areas adjacent to the lava flows.

Temporary Camps. The definition for this site type is that:

> Temporary camps are sites that were occupied for a short length of time...by a few peoples....These sites can be identified archaeologically by scattered artifacts, tool manufacturing debris, fire-affected rocks and possibly features. The inferred function of the site is limited camping (i.e., limited subsistence and maintenance activities)... (BLM 1977:Attachment 3:2).

Three of these site types were encountered in the pediment/arroyo locale, 29 in the dunes locale, and 13 in the Mojave Sink locale. Table 18 shows the distribution of these sites by stage and locale. Of the three temporary camps in the pediment/arroyo, two are located on gravel ridges just north of West Cronese Lake and were probably utilized

during the exploitation of the lakes' resources. One temporary camp is 4.5 miles northwest of the lake on a volcanic ridge, and may have been used during the exploitation of the chert float material in the surrounding terrain. The 29 temporary camp sites within the dunes locale are situated either near East or West Cronese Lake in the low fixed, anchored dunes which surround both lakes. These sites also relate to the prehistoric aboriginal exploitation of the lakes' resources. The 13 Mojave Sink locale sites are also situated in anchored dunes within the Sink, and their situation is related to the extensive available resources of that environment. A great many of these sites have been previously recorded during prior archaeological research within the East and West Cronese Lakes area and the Mojave Sink.

The sites around the East and West Cronese Lakes were utilized probably when the lakes contained water, which occurs during precipitation periods or when the Mojave River overflows. The water is a fluctuating factor, varying from one year to the next in prehistoric time, but when present would have been encompassed by vegetation, with associated animals and migratory birds. These temporary camps would then have a widespread chronological distribution even though they are geographically concentrated in a relatively small area.

The Mojave Sink today contains extensive stands of mesquite trees and has a relatively stable subterranean water source. In conjunction with these aspects, this environment is the habitat of numerous small reptiles, rodents, rabbits and other wildlife. These flora and fauna would have served as a reliable environmental resource to aboriginal populations.

Milling Station. This site type is a manifestation of food processing tools, either as the dominant tool or as the only tool on the site. Artifacts considered as food processing tools in this project area include manos, metates, pestles and a few portable mortars. Four milling stations were encountered, two of them located in the dunes locale found in Stage 3, and two in the Mojave Sink locale found in Stage 1. Three of the four sites contained food processing tools only, and the other site contained food processing artifacts, a few flakes and a few potsherds.

These four sites are located near the East Cronese Lake or the Mojave Sink, and the plant foods processed could have been derived from the vegetation surrounding the lake or adjacent to the sink. The Cronese Lake sites are situated on the highest beach terrace and are in the process of being destroyed by erosion through the seasonal fluctuations of the water level in the lake.

Pottery Locus. A pottery locus is a site that consists solely of potsherds. Five pottery loci were encountered; one in the dunes stratum and four in the Mojave Sink locale. Table 18 shows the distribution of these sites by stage and locale. The sherdware fragments observed were not sufficiently similar to have been fragments of the same pottery vessel. The sherds are plainware and were field identified, mainly as Lower Colorado Buffware.

Isolate Sites. This type of site contains reworked flake material or single lithic artifacts. Six of these sites were identified during the three stages (see Table 18); one in the mountain/hill locale, four in the pediment/arroyo locale, and one in the Mohave Sink locale.

## Artifact Interpretation

Diagnostic cultural material observed on prehistoric sites during the survey in the project area was rare, only two complete projectile points and some sherdware fragments. Few other recognizably diagnostic artifacts were field identified and recorded. At one site the diagnostic cultural material consisted of a complete Mojave Lake point and several side edge scrapers (possibly diagnostic), all observed on Site A, in Transect MB-311. This site is on a beach remnant approximately 940 feet elevation above the present Silver Lake playa. The Mojave Lake point could be considered part of the San Dieguito Complex (T. King 1976) and dated approximately 6,500 to 11,000 B.C. (Hester 1973). Side edge scrapers are listed among the artifact types, also for sites of the San Dieguito Complex. The strand line on which the Mojave Lake point and associated lithics was observed is the highest visible strand line of the Pleistocene Lake Mojave. Opinions vary, but this strand line and the point may date around 10,000 years ago.

The only other diagnostic projectile point type was observed on Site A, in Transect MB-631, and closely resembles a Rose Spring side notched point. This point may generally fit within the Amargosa Complex, Phase 2, which contains side notched point types, or Period IV, Saratoga Springs (Warren and Crabtree, in press). The temporal span is not yet clarified, but could range from A.D. 0 to A.D. 500 or A.D. 1,000, depending on the archaeological chronology consulted. A single nondiagnostic point tip was observed in the Mojave Sink area.

King et al. (1976) have presented a detailed description from the East Mojave Desert region of pottery types, many of which have been defined from sites located within the southern Owlshead/Amargosa and Mojave Basin Planning Unit. The sherdwares that have been defined by Rogers include

Cronese Brown and Crucero Brown wares, which he stated were most common near Soda Lake. He identified these wares as belonging to the Yuman II phase of his sequence, A.D. 1150-1500. Many of the sherds observed on sites in the field were recorded as plain ware sherds, plain brownwares and fewer graywares. These could belong to Rogers' Cronese Brown or Crucero Brown wares. This identification is particularly applicable to those sherds recorded on sites in the vicinity of the East and West Cronese Lakes or in the Mojave Sink area.

Lower Colorado Buffware has also been previously located in the Mojave Sink area, including some decorated sherd types. During this survey, all the sherds observed that were field identified as Lower Colorado Buffware, are plain ware types. These plain wares probably date to between A.D. 900 and A.D. 1400, although there appears to be no overall agreement as to the internal chronological sequence of these Lower Colorado Buffwares within the region of the project area.

The remainder of the prehistoric cultural materials observed during the survey of the transects consisted of non-diagnostic lithics, numerous waste flakes, occasional worked flakes, some cores, a few scrapers and knives. There appears to have been an absence of any large lithic tradition, at least on those sites that were examined and recorded. Ground stone implements include fragments of metates, occasional manos and a fragment of a possible pestle. In the temporary campsites recorded during the survey the association of these ground stone implements with sherdware would imply a relatively late date of at least post-A.D. 900. None of the ground stone implements were found with diagnostic lithic materials.

A tip of a single bone awl and shell disc beads were observed on Site A, in Transect MB-631. The potential date for the side notched projectile point, also found on this site, does not necessarily apply to these artifacts.

The determination of chronological interpretation from the field observation of prehistoric artifacts in the project area, particularly in the East and West Cronese Lake, the Mojave Sink and the Soda Lake areas, would be extremely dubious at the present time. These areas have been collected by professionals and nonprofessionals over the last sixty years. In addition, there has been heavy use of this region by ORV vehicles, recreational vehicles of all types, campers, World War II maneuvers, railroad activities, and historic mining. Based on these disturbances the present surface association of artifacts on a site is of questionable reliability. The lack of projectile points in easily accessible site areas is also apparent. In a total of 89 recorded prehistoric sites, only two complete projectile

points and one point fragment were observed. From Rogers' site descriptions and discussion it is apparent that, at the time he was conducting his research, sites that he recorded within the project area contained numerous projectile points, more distinctive sherd ware and many other artifact types.

Site Frequency Interpretations as Indicators of Site Patternings

Environmental variables were correlated with the geomorphic designations during the initial sampling design, and designated as strata. Frequencies of historic and prehistoric sites subsequently have been independently determined for significance of environmental site types in geomorphic locales. The occurrence of sites by strata are shown in Tables 15 through 17, and in Section 6, Table 13, and the transect geomorphic designation is based on the dominant land form in that transect. The type of sites by locale as shown in Tables 18 and 19 refers to the specific environment, or geomorphic locale in which the site itself was found. Not only are site types separated by whether they are historic or prehistoric, their specific identification is delineated, thus providing an indication of site patternings for the 1% sample of the study area. The frequency expresses the percentage of cultural manifestations in a given environmental situation, usually related to available resources. Environment is a larger determining factor prehistorically for resources than historically for resources, as is apparent in Table 19 by the percentage frequencies.

Historic settlements appear to be linked to economic variables. Town or camp, mines, railroad (considering each railroad berm encountered as separate) and the water tank account for 88% of the historic sites observed. Twelve percent of the historic sites encountered were related to the environment. These were the two ranching areas located in the pediment locale.

Initial resource data indicates two significant categories of environmental attributes. In the dune and Mojave Sink environs frequencies of prehistoric sites were significantly higher than historic sites. Twenty-nine percent of all prehistoric sites occur in dune locales, while only 5% of all historic sites were observed in the same environment. Twenty-nine percent of all historic sites occur in the Mojave Sink, while 14% of all historic sites are in this locale. Table 19 summarizes these frequencies by stage of prehistoric and historic sites within the different geomorphic locales and/or environmental variables. These frequencies have reference to those variables in the vicinity of the site situation and do not reflect the geomorphic stratum of the transect in which the site was located.

TABLE 19

FREQUENCY OF SITES TO GEOMORPHOLOGICAL LOCALE

| | Stage | # of Hist. Sites | Frequency of Hist. Sites | # of Prehist. Sites | Frequency of Prehist. Sites |
|---|---|---|---|---|---|
| Mountain and Hill | 1 | 5 | 14% | 6 | 5% |
| | 2 | 1 | 3% | 3 | 3% |
| | 3 | 6 | 16% | 2 | 2% |
| Pediment | 1 | 8 | 21% | 12 | 11% |
| | 2 | 2 | 5% | 6 | 5% |
| | 3 | 5 | 14% | 15 | 13% |
| Dunes | 1 | 0 | | 0 | |
| | 2 | 0 | | 2 | 2% |
| | 3 | 2 | 5% | 31 | 27% |
| Mojave Sink | 1 | 0 | | 9 | 8% |
| | 2 | 1 | 3% | 8 | 7% |
| | 3 | 4 | 11% | 16 | 14% |
| Lava | 1 | 0 | | 0 | |
| | 2 | 0 | | 1 | 1% |
| | 3 | 0 | | 3 | 3% |
| Playa | 1 | 2 | 5% | 0 | |
| | 2 | 0 | | 0 | |
| | 3 | 1 | 3% | 0 | |
| Total | | 37 | | 114 | |

It is believed that the high frequency of historic sites located on the pediment and mountain locales is due to the amount of mining activity within these geomorphic attributes. These percentages do not express any environmental correlation with edible resources, except by coincidence. The frequency of prehistoric site occurrences on pediments relates to the availability of float quarrying materials, as well as utilizable edible plants.

The unnamed dry lake, just north of the Silver Lake outlet, and Silurian Lake as part of a Pleistocene lake and drainage system, have the potential of containing the sub-surface remains of early archaeological materials. In the Pleistocene all of these lakes were part of a drainage system, flowing north from Lake Mojave through the Amargosa River and draining into Lake Manly (Morrison 1965). One reason there may be sub-surface materials around these present playas is that, at the end of the Pleistocene when Lake Mojave was reduced to a series of smaller lakes, and Silver Lake no longer discharged water northward into the unnamed dry lake and Silurian Lake, these lakes became playas fed only by rain waters from the slopes and arroyos adjacent to them. Subsequently, as these playas filled with alluvial sediments, earlier archaeological remains may have been buried beneath this debris.

Distribution correlations with environmental attributes should only be addressed to prehistoric sites. The environment was an integral aspect of prehistoric peoples, both for subsistence and for the development and maintenance of their cultures. Historic correlations to the environment are (at best) anthropomorphic constructs and do not exhibit the same land use relationships employed by prehistoric peoples. This is particularly true for this project area, since by the time the region was settled historically outside resources for subsistence were available through wagon roads and later railroads.

## Discussion

A total of 151 prehistoric and historic sites (not including isolated finds) were recorded during the survey with 148 transects, 58% of which were selected randomly and 42% non-randomly. Based on the results of the two randomly selected stages it is felt that a two stage survey, with approximately 40% of the transects randomly selected and about 60% of the transects non-randomly selected, might prove more effective than a three stage design. The randomly selected transects provide an overview of site distribution and predictability within designated geomorphic units and give clues to areas where quarrying material may occur, to an understanding of the terrain, and a concept of aboriginal use of the available biotic resources. The

non-random transects would be oriented towards situations which the random transects have indicated are potentially productive of site frequencies.

Assigning a transect to a geomorphic stratum, when 50% or more of the transect falls within that geomorphic designation, does not express the reality of the variable environments that might occur within that transect. Since the transect concordance by geomorphic stratum, for the most part, was 40% or less, site prediction, density and site patternings were difficult to determine on this basis. Geomorphic locale, or the precise geomorphic designation of the site situation, has provided a higher confidence level of predictability and site patternings. Miller (Section 6) has used the term "geomorphic unit" in Stage 3, which refers to the geomorphic locale of the site. The higher yields resultant from these geomorphic units are apparent in her final graphs and also in Tables 18 and 19 (pp. 152, 160).

Historically and prehistorically, the pediment valley areas appear to have been heavily utilized. When mountain/hill sites are combined with pediment sites, thirty-five prehistoric sites that are lithic scatters of various types were recorded in these two locales. This prehistoric distribution of lithic sites in these geomorphic locales is based on the available quarryable materials as float, and exposed veins of chert or other utilizable lithic sources as the lava flow area. Historically, mining activities are highest in these same areas.

Prehistoric campsites occur in highest frequencies within the dune or Mojave Sink geomorphic locales and these are assumed to relate to seed-gathering activities within an environment which has a number of available plant resources, the most significant being mesquite. Dune locales also contain numerous small fauna. Essentially, the clustering effect of sites is apparent in the East and West Cronese Lakes and the Mojave Sink area, as well as adjacent pediment locales where these potential environmental resources were available.

Unfortunately, these dune and Mojave Sink areas recently are heavily utilized by recreationally oriented people, and most of these sites are readily accessible and have been disturbed or destroyed. Much of the predictability of aboriginal use patterns here has been lost through the disturbance of the sites, their surface configurations and the associated artifacts. This is particularly true in the East Cronese Lake and Mojave Sink areas, where there is an abundance of vehicular traffic during any weekend or holiday period.

The most sensitive areas within the project region where site clusterings are recorded are the Mohave Sink,

extending approximately from the east end of Afton Canyon to the western edge of the Devil's Playground (designated the Mojave River Wash on the U.S.G.S. maps) and the East and West Cronese Lakes. The Silver Lake area, although significant archaeologically, does not have the heavy recreational activities at present that are occurring in the dune areas of the Mojave Sink and the Cronese Lakes. Prior to any management decision of locales where recreational activities could be allowed, some type of studies should be made to determine the human impact on both the natural and the archaeological environmental resources.

The function of this preliminary study, from the archaeological research point of view, has been to enlarge the knowledge about prehistoric and historic locations in the southern half of the Owlshead/Amargosa Planning Unit and the Mojave Basin Planning Unit. This report is part of the overall endeavor being conducted by the Desert Planning Unit of the Bureau of Land Management in their efforts to synthesize the results of a series of research studies for that portion of the Mojave Desert located in southeastern California. This has taken a tremendous amount of coordination and cooperation between the staff of the Desert Planning Unit, under the direction of Eric Ritter, and the various archaeological research teams working in the field. The data that have been collected as a result of these efforts will prove to be of value to a broad spectrum of disciplines within the scientific community.


Illustration of a "Ceremonial (alignment) on a high gravel mesa north of M-O site on East Cronese." Site reported as M-O-A by Malcolm Rogers. Illustration copied from Rogers' notes, on file at the San Diego Museum of Man, by Russell L. Kaldenberg.

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Depicted within the central portion of this photograph is an alignment of sixteen rock cairns. The site is located in the Mojave Basin Planning Unit on the south bank of the Mojave River just west of Afton Canyon. Photo courtesy of Harry Casey.